**US Army Corps
of Engineers**
Waterways Experiment
Station

Development of a Multispectral Signatures Database (MSD) for the Camouflage, Concealment, and Deception Design and Evaluation Environment (C2D2E2)

Report 2
User's Manual

*by   Gerardo I. Velázquez, WES
Sandy D. Bratcher, Douglas P. Roussell,
Nichols Research Corporation*

Approved For Public Release; Distribution Is Unlimited

DTIC QUALITY INSPECTED 4

19970715 222

The contents of this report are not to be used for advertising, publication, or promotional purposes. Citation of trade names does not constitute an official endorsement or approval of the use of such commercial products.

The findings of this report are not to be construed as an official Department of the Army position, unles so designated by other authorized documents.

Development of a Multispectral Signatures Database (MSD) for the Camouflage, Concealment, and Deception Design and Evaluation Environment (C2D2E2)

Report 2
User's Manual

by   Gerardo I. Velázquez

U.S. Army Corps of Engineers
Waterways Experiment Station
3909 Halls Ferry Road
Vicksburg, MS   39180-6199

Sandy D. Bratcher, Douglas P. Roussell

Nichols Research Corporation
P.O. Box 820186
Vicksburg, MS   39182-0186

Report 2 of a series

**US Army Corps
of Engineers**
Waterways Experiment
Station

INFORMATION
TECHNOLOGY
LABORATORY

HEADQUARTERS
BUILDING

MAIN
ENTRANCE

COASTAL &
HYDRAULICS
LABORATORY

GEOTECHNICAL
LABORATORY

ENVIRONMENTAL
LABORATORY

STRUCTURES
LABORATORY

FOR INFORMATION CONTACT:
PUBLIC AFFAIRS OFFICE
U.S. ARMY ENGINEER
WATERWAYS EXPERIMENT STATION
3909 HALLS FERRY ROAD
VICKSBURG, MISSISSIPPI 39180-6199
PHONE: (601) 634-2502

SCALE

AREA OF RESERVATION : 2.7 sq km

Contents

Preface

U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

1   Introduction

The U.S. Army Engineer Waterways Experiment Station (WES) Camouflage, Concealment, and Deception (CCD) Research Group provides CCD for fixed tactical assets. Worldwide Department of Defense assets include installations such as logistics bases, supply depots, and other permanent and semimobile assets. As part of this mission, the CCD Research Group has been actively gathering multispectral imagery of fixed and semi-fixed facilities for several years. With this imagery there are ground truth and physical data collected relating to the visual, near infrared, thermal, and radar bands. Similar data have been collected within other agencies and accumulated in existing Government databases. The Camouflage, Concealment, and Deception Design and Evaluation Environment (C2D2E2) is being developed as a unique group of integrated software applications designed specifically to address this challenge. As part of this effort, WES has begun the development of a multispectral signatures database (MSD) to handle all the data available.

CCD analysts and engineers defined data requirements (image attributes) and high-level operational requirements for this database to handle the great amount of information available at WES and other Government agencies. High-level operational requirements included: organizing and cataloging a large number of images, associating appropriate attribute data with each image, associating images of the same scene in different spectral bands, and retrieval of related images and their respective attribute data. Raima Data Manager (RDM) was used for the underlying Database Management System. The network technology provided by RDM was used to support complex relationships such as object signatures in a large number of scenes. These relationships are very inefficient and sometimes not configurable with typical relational technology. For image storage, a 24-bit color Tagged Image File Format was used due to the flexibility and wide support for this format.

The MSD is hosted on a 486 IBM PC and has undergone development in the ANSI C language. The network technology provided by RDM was used due to its support of complex relationships that are not efficiently represented with typical relational technology. For image storage, a 24-bit color Tagged Image File Format (TIFF) was used due to the flexibility and support for this format. A single-user menu interface is provided for the management of the database. Some of the operational requirements that were defined for this user interface include: organizing and cataloging a large number of images;

associating appropriate attribute, ground truth, and physical data with each image; associating images of the same scene in different spectral bands; and the ability to retrieve/display images and their respective data.

This report summarizes the installation, data forms required and the procedures for collecting the data required for the population of the MSD.

2　Installation

Hardware and Software Requirements

The MSD software is hosted on a 486DX IBM-compatible PC with MS-DOS version 6.0 and 8 MB RAM. A VESA SVGA or a Paradise SVGA video card and a minimum of 4 MB of expanded memory is required only for image display.

To run the MSD software, 600 KB hard disk space is required plus a minimum of 75 KB for each database created. The MSD source code and libraries needed for recompiling the MSD require an additional 2.2 MB hard disk space.

The following software is also required ONLY to maintain or modify the MSD software:

- Microsoft C version 6 (compiler).

- Plink86 version 2.3 by Sage Software (used for overlay linker).

- Raima Data Manager System III version 3.21 -- Single user version for Microsoft C 6.0 (RDM library to link with MSD software).

- db_QUERY version 2.21 (db_QUERY library to link with MSD software).

- db_REVISE version 1.04 (db_REVISE utility to revise the database schema).

  NOTE: Only the Database Administrator should make changes to the database schema. Changes to the database schema will require corresponding changes to the MSD software!!!

- Victor Image Processing Library version 2.2 by Catenary Systems (image display library to link with MSD software).

- TLIB Version Control software version 4.12 by Burton Systems Software (for source code configuration).

To install the MSD software on another PC, an installation disk can be created by copying the following files from your MSD root directory onto a diskette:

- **UI.EXE**   MSD System Executable

- **IMAGEDBS.DBD**   MSD Data Dictionary. The environment variable DBDPATH is set by the MSD software to the MSD root directory to indicate where the data dictionary file for the MSD is located.

- **DB_QUERY.DBD**   db_QUERY Temporary Sort Database Data Dictionary. The environment variable QBDPATH is set by the MSD software to the MSD root directory to indicate where the data dictionary file for the db_QUERY temporary sort database is located.

- **PREPROC.EXE**   MSD Preprocessor. Stand-alone utility for formatting MSD data files before entry into MSD.

- **BROWSE.COM**   File browser called from within MSD.

To install, simply create an MSD root directory and copy the files from the diskette into your new directory.

Configuration

Because of the number of database files associated with the MSD, the file limit imposed by DOS must be increased. This limitation can be increased by setting "files=100" in your system configuration file (CONFIG.SYS). Reboot the system if you must edit the CONFIG.SYS file to adhere to this requirement.

Invocation

To invoke the MSD software, set the default directory to the MSD root directory and then enter "UI" at the DOS prompt as follows:

c:\msd> UI

NOTE: It is imperative that the system administrator make regular backups of database files and image files because of the possibility of database corruption if the system malfunctions during MSD software execution.

3   Using the MSD Software

The following section describes the MSD user interface.

Document Conventions

"prompts"—prompts are bolded and in double quotes

menu_commands—menu commands are bolded

Description of the MSD Menu

As depicted in Figure 1, each menu displayed in the MSD application consists of four functional areas (from top to bottom): the menu line, the prompt line, the data entry/display area, and the status display area.

Selection Line   The Selection Line displays user selections that navigate the user through the MSD application as selections are made. There are two methods available to the user for making selections. The first method is to use the left and right arrows keys. The arrow keys move through the available selections, highlighting the current selection. When the desired selection is highlighted, the "Enter" key may be pressed to initiate the selection. The second method is to enter a single character. Each available selection on the Selection Line contains one capital letter. The capital letter can be entered to go directly to that selection, making it the current selection. When the desired selection is highlighted, the "Enter" key may be pressed to initiate the selection. The two methods described for making user selections may be used interchangeably. Currently, the mouse cannot be used to make selections. When a selection is made, either a new Selection Line will be displayed or a prompt will appear. To abort a selection, the "Esc" key will frequently suffice, although sometimes a required data entry or "Enter" may be needed.

```
┌─────────────────────────────────────────────┐
│ ┌─────────────────────────────────────────┐ │
│ │ Selection Line                          │ │
│ ├─────────────────────────────────────────┤ │
│ │ Prompt Line                             │ │
│ │─────────────────────────────────────────│ │
│ │                                         │ │
│ │                                         │ │
│ │                                         │ │
│ │   Data Entry / Data Display Area        │ │
│ │                                         │ │
│ │                                         │ │
│ │                                         │ │
│ │─────────────────────────────────────────│ │
│ │                                         │ │
│ │   Status Display Area                   │ │
│ │                                         │ │
│ └─────────────────────────────────────────┘ │
└─────────────────────────────────────────────┘
```
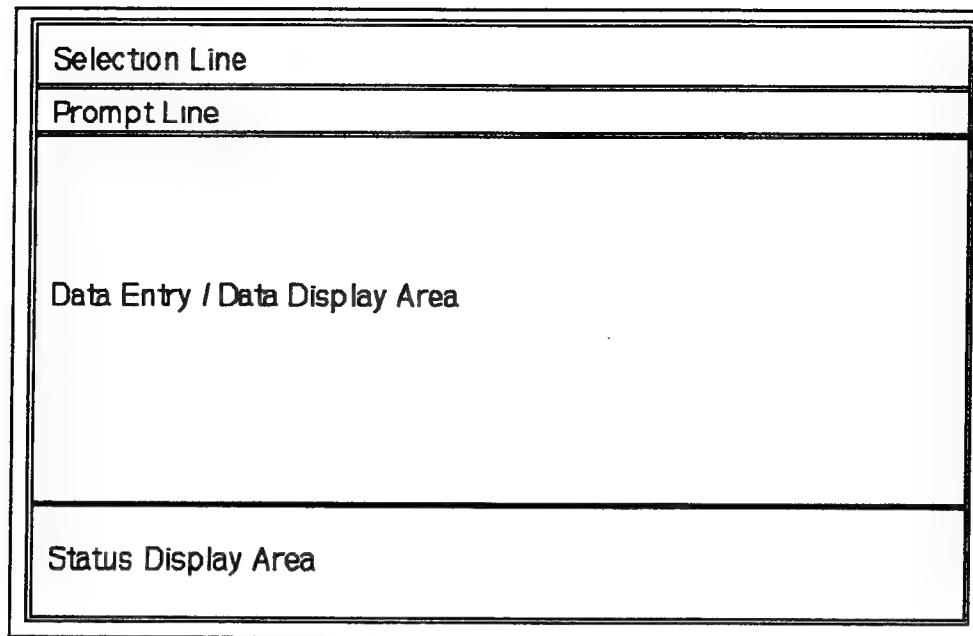
Figure 1.   Functional areas of the MSD menu

Prompt Line   The Prompt Line is used as a message display area. On the Prompt Line, a prompt may be displayed indicating the next required data entry to the user. Also the Prompt Line is used to display informational messages and error messages. Descriptions of error messages can be found in **Section 5**.

Data Entry/   The Data Entry/Display Area is used to collect data
Data Display entry values and to display data values. During data
Area   entry, data items are displayed one at a time for which data entry is either required or optional. Data items that are displayed with a preceding "*" are data items for which data entry is required; data entry for other data items is optional.

Status   The Status Display Area lists the current User, the
Display Area current Operation, and the Database (DB_FILE) currently in use.

Initial MSD Menu

When the MSD software is invoked, the initial MSD menu is displayed (Figure 2).

The user is prompted to enter a valid username at the USER prompt in the Status Display Area. The username/password function was not implemented due to memory and time constraints. The only valid username is "ccd" or

6

```
┌──────────────────────────────────────────────────────┐
│  ╔════════════════════════════════════════════════╗  │
│  ║                                                ║  │
│  ╟────────────────────────────────────────────────╢  │
│  ║      Please enter case sensitive valid username║  │
│  ╠════════════════════════════════════════════════╣  │
│  ║                                                ║  │
│  ║                                                ║  │
│  ║                                                ║  │
│  ║                                                ║  │
│  ║                                                ║  │
│  ║                                                ║  │
│  ║                                                ║  │
│  ║                                                ║  │
│  ╠════════════════════════════════════════════════╣  │
│  ║              USER:                             ║  │
│  ║         OPERATION:                             ║  │
│  ║            DB_FILE:                            ║  │
│  ╚════════════════════════════════════════════════╝  │
└──────────────────────────────────────────────────────┘
```
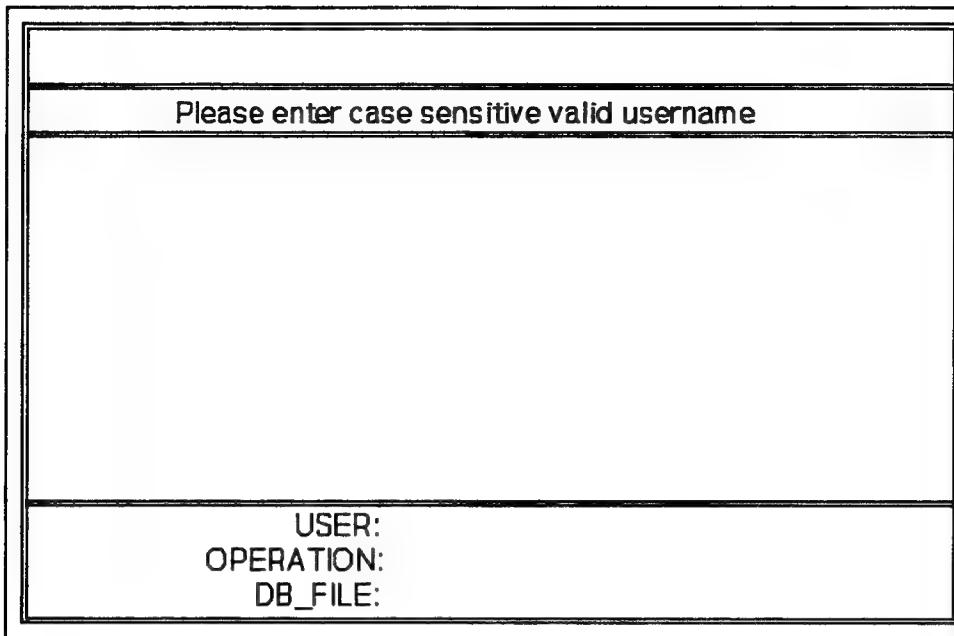
Figure 2.   Initial MSD menu

"CCD." Next, the user is prompted to enter a password at the Prompt Line. The only valid password is "ccd" or "CCD."

Database Selection/Creation Menu

After entering a valid username and password, the Database Selection/Creation menu is displayed (Figure 3).

The user must first select the MSD with which to work. Descriptions of the available commands follow.

Open_DB   This command may be selected to open an existing MSD that has already been created by the MSD application in a previous session. The current directory path is displayed on the Selection Line. Available databases in the current directory are displayed in the Data Entry/Data Display Area. The following prompt is displayed on the Prompt Line: "**Select database to open or PgUp to enter new path.**" The user may select one of the databases displayed in the current directory. Or the user may press the "Page Up" key to enter a different directory path and then select one of the databases displayed from the new directory. After a database is selected, the Database Command Selection Menu is displayed.

```
┌─────────────────────────────────────────────────────────────┐
│  ┌───────────────────────────────────────────────────────┐  │
│  │   Open_DB            Create_DB              eXit_DB    │  │
│  ├───────────────────────────────────────────────────────┤  │
│  │  Welcome to the USAE WES Multispectral Signatures Database│  │
│  ├───────────────────────────────────────────────────────┤  │
│  │                                                       │  │
│  │                                                       │  │
│  │                                                       │  │
│  │                                                       │  │
│  │                                                       │  │
│  │                                                       │  │
│  ├───────────────────────────────────────────────────────┤  │
│  │             USER:  ccd                                │  │
│  │        OPERATION:  Open/Create DB files               │  │
│  │          DB_FILE:                                     │  │
│  └───────────────────────────────────────────────────────┘  │
└─────────────────────────────────────────────────────────────┘
```
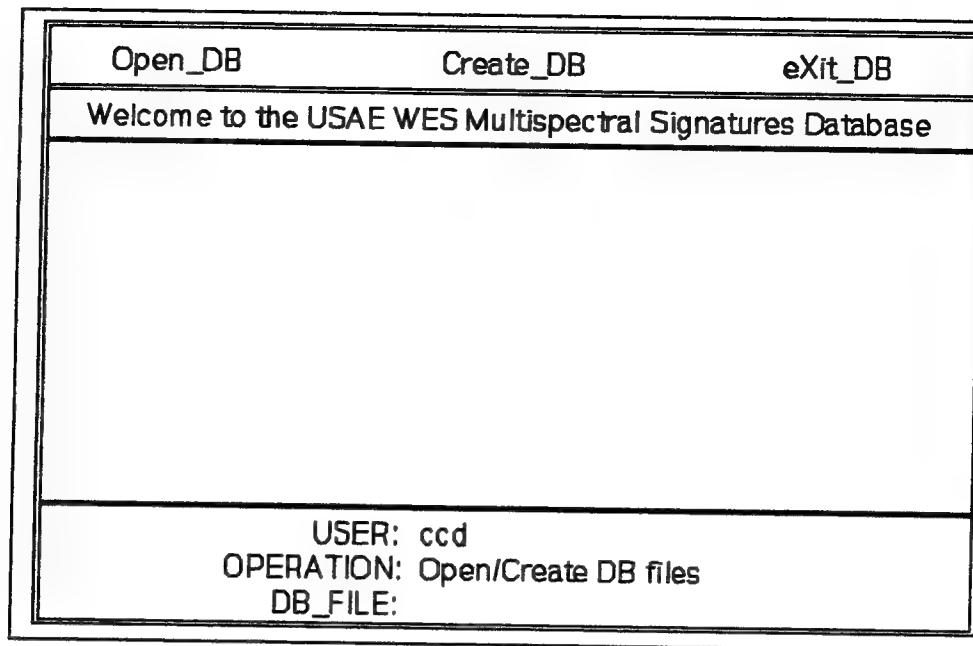
Figure 3.   Database selection/creation menu

Create_DB   This command may be selected to create a new MSD. A
"**path:**" prompt is displayed on the Selection Line. The user
may press "return" to accept the current path (although it is
not displayed) or the user may enter a new path and then
press "return." The user is then prompted on the Selection
Line to "**Enter database filename < 8 characters or less>.**"
A database name should be entered on the Prompt Line in
eight or less characters. The eight-character filename limit is
a DOS limitation because the database name will be created
as a subdirectory with a ".DDD" extension. This subdirec-
tory will be used to store all database files for this database.

NOTE: There can be multiple MSD containing data col-
lected from different data collection efforts. However,
queries cannot be made across multiple databases. With this
in mind, be careful in selecting how to partition your data
into separate databases. Also note that in general the larger
the database, the slower the response time when querying the
database.

eXit_DB   This command may be selected to exit the MSD application
and return to the DOS prompt.

Database Command Selection Menu

After the MSD is selected, the Database Command Selection menu is displayed (Figure 4).

```
┌──────────────────────────────────────────────────────────────────┐
│ ┌────────────────────────────────────────────────────────────────┐ │
│ │                                                                │ │
│ │  Add      Delete     Query     mOdify     VIew       eXit       │ │
│ │ ──────────────────────────────────────────────────────────────  │ │
│ │                                                                │ │
│ │ ──────────────────────────────────────────────────────────────  │ │
│ │                                                                │ │
│ │                                                                │ │
│ │                                                                │ │
│ │                                                                │ │
│ │                                                                │ │
│ │                                                                │ │
│ │                                                                │ │
│ │                                                                │ │
│ │                                                                │ │
│ │ ──────────────────────────────────────────────────────────────  │ │
│ │              USER:  ccd                                         │ │
│ │       OPERATION:  Command Input                                │ │
│ │          DB_FILE:  TEST.DDD                                     │ │
│ └────────────────────────────────────────────────────────────────┘ │
└──────────────────────────────────────────────────────────────────┘
```
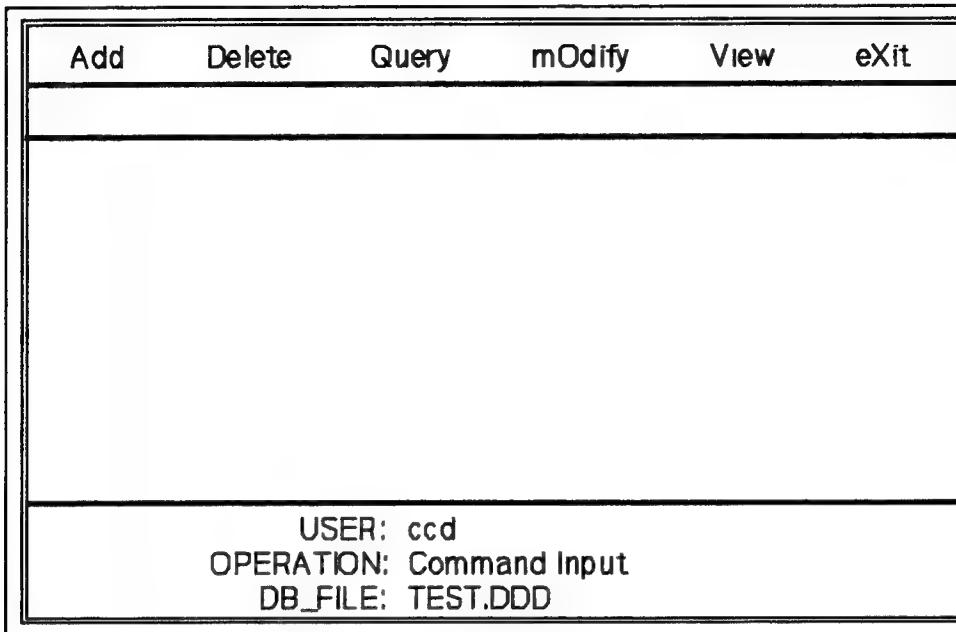
Figure 4.   Database Command Selection Menu

A database operation to perform should be selected. A description of the available database commands follow.

Add   The ADD command may be selected to add a new record to the current MSD.

Delete   The DELETE command may be selected to delete an existing record from the current MSD.

Query   The QUERY command may be selected to query for all records of a particular record type. This query cannot be customized.

mOdify   The MODIFY command was not implemented due to memory and time constraints.

View   The VIEW command may be selected to view images that have been added to the view file, viewimgs.dat. Images are added to the view file during the **Query** command operation where the user is given the option to write image data to the view file. Therefore, the **Query** command would have to have been selected and at least one image added to the view file before selecting this **View** command.

eXit   The EXIT command may be selected to close the current database and return to the Database Selection/Creation menu.

Record Selection Menu

Upon selection of a database command (other than **View** or **eXit**), the Record Selection menu is displayed (Figure 5).


```
┌─────────────────────────────────────────────────────────────┐
│  DCE   Site   sCene   Images   Object   dAta   eXit          │
│                                                              │
│                                                              │
│                                                              │
│                                                              │
│                                                              │
│                                                              │
│                                                              │
│                                                              │
│                                                              │
│                   USER: ccd                                  │
│            OPERATION: Add Command                            │
│               DB_FILE: TEST.DDD                              │
└─────────────────────────────────────────────────────────────┘
```
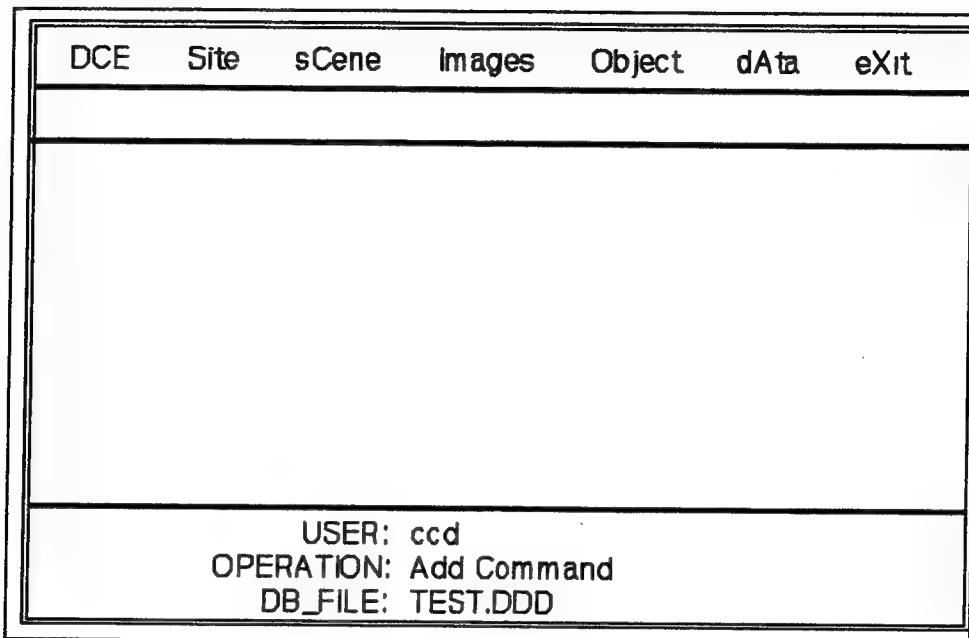
Figure 5.   Record selection menu

DCE   The Data Collection Effort (DCE) record type may be selected to perform one of the database maintenance functions (**Add, Delete, or Query**) on a DCE record for the currently opened MSD database.

Site   The Site record type may be selected to perform a database maintenance operation on a Site record for the currently opened MSD.

Scene   The Scene record type may be selected to perform a database maintenance function on a Scene record for the currently opened MSD.

Images   The Images record type may be selected to perform a database maintenance function on an Images record for the current MSD.

Object   The Object record type is selected to perform a database main-
tenance operation on an Object record for the currently opened
MSD.

Data   The Data record command may be selected to perform a database
maintenance function on a Data record for the currently opened
MSD. Data records include Ground Truth Data (Meteorological or
Calibration Panel Data files) and Physical Data (Chromatic, Gloss
Meter, Radiometer, or Spectral Radiometer Data files).

Adding a Record

To add a record to the currently opened MSD, select the **Add** command
from the Database Commands Menu. The user will then be taken to the
Record Selection Menu. Select the appropriate record type for the record to be
added to the current MSD and follow the instructions below.

Adding a Data Collection Effort Record

Selecting **DCE** from the Record Selection Menu allows the user to add a
new Data Collection Effort record to the current MSD. The MSD command
interface will respond to this request by prompting the user to input data for
each of the DCE fields. These input fields are shown below:

*Data Collection Effort Name:
    Example: 21st TAACOM Conspicuity Analysis
 Date begun (YYYY/MM/DD):
 End date (YYYY/MM/DD):

Note: Input fields denoted by (*) are required. The MSD interface will not
allow the user to leave these input fields blank. All other input fields are
optional.

Once the <Enter> key is pressed in the End date field, the new Data Col-
lection Record is entered into the current MSD, or an error message is dis-
played on the Prompt/Message line upon encountering an error in adding the
record. At any point prior to pressing <Enter> on the End date field, the user
may abort the operation by hitting the <Esc> key.

Adding a Site Record

A new Site record may be added to the MSD by choosing **Site** from the
Record Selection Menu.

Since each Site record must be owned by a Data Collection Effort record,
the user begins by selecting the appropriate Data Collection Effort to which the

new Site record will belong. Next, the user is given the option of selecting an existing Site Name or entering a new Name and Location for the Site to be added. The remaining Site fields, a one-line description of the Area of Interest, and the Date Begun and End Date, are entered, and the Site record is added to the currently opened database (or an error message is displayed on the Prompt/Message line if an error is encountered).

The input fields for a Site record are shown below:

*Site Name:
    Example: Miesau Army Depot
*Site Location:
    Example: Miesau, Germany
*Enter a one-line description of Area of Interest:
->
    Example: Pomcus buildings
    Note: One Site may have one or more Areas of Interest. For example, the above Site (Miesau, Germany) may have a second Area of Interest, say, "Underground bunkers."
Date begun (YYYY/MM/DD):
End date (YYYY/MM/DD):

The user may abort the operation at any point before End Date is entered by pressing <ESC>.

Adding a Scene Record

To add a Scene record to the current MSD, select sCene from the Record Selection Menu.

Any Scene record added to a database must have an owner Site record. The user may select this Site record either directly by Site Name or by first selecting a DCE and then a Site. Once the owner Site has been selected, the contents of the Scene record's fields can be entered. These input fields are shown below:

*Enter a one line Scene description:
->
    Example: Clam shelter w/o camouflage, 1,000 m
*Date captured (YYYY/MM/DD):
*Season captured: Spring Summer Fall Winter
Image collection platform Latitude (degrees):
    Example: 30.0
Image collection platform Longitude (degrees):
    Example: 30.0
Image collection platform Altitude (meters):
    Example 1000.0

Image collection platform Boresight Azimuth (degrees from magN or ~dir):
    Example: 230.0, or ~SW

Pressing <Enter> at the last field adds the new Scene record to the MSD database. At any point prior to this, the user may abort the transaction by hitting the <Esc> key. Upon addition of a new Scene record, a success message will be displayed, or if an error is encountered, an error message will appear on the Prompt/Message line.

Adding an Images Record

A new Images record may be added to the database by selecting **Images** from the Record Selection Menu. Images introduced into an MSD must be in TIFF file format. Each Images record must have an owner Scene record. The user may select the owner Scene by traversing the MSD hierarchy from DCE or Site down to Scene. Next, a list of available Images spectra is displayed, and the appropriate spectrum is selected. The MSD will allow at most one image of a particular spectrum to be associated with each Scene (i.e., one of each of the following: Visual, Infrared 3-5, Infrared 8-12, Near IR, and Low-light, for a maximum of five Images per Scene).

The data fields for each Images record are listed below:

Available analog formats:
Enter S in the first blank if Slide media is available -
    X if not
Enter P in the second blank if Print media is available -
    X if not
Enter V in the third blank if Video media is available -
    X if not

Example: If Print and Video media is available, but Slide is not, the user would enter:

X P V

Type of recording media:
    Example: Medium format
Time captured (HH:MM:SS:FF):
    Example: 11:30:00:05
    (Time captured is 11:30am and 00 seconds, and frame is number is 5).
*Destination volume:
    Example: IMAGEVOL
    (The volume name of the destination volume, which must be the LAST
drive).
    *Image file name to add (full file spec) :
        Example: C:\CLAMSHEL\CLAM.TIF
            Reminder: Image must be in TIFF file format.

After a valid response is made to all required fields, the new Images record is added to the MSD database and the image specified by the given file spec is moved to the destination volume. An error message will be displayed on the Prompt/Message line if an error is encountered during this transaction. At any point before the specification of the input image, the Add operation can be aborted by hitting the <Esc> key.

Adding an Object Record

. New Object records are added by choosing **Object** from the Record Selection Menu.

Each Object added to an MSD database is linked to a Scene in that database through the Scene-Object Intersect record, which contains two fields: the Slant-range field and Look-angle field.

The user may select the Object to be added to the selected Scene from a list of available Objects (i.e., Objects in the database which are not already in the Scene), or hit the <Page Up> key to enter a new Object. If a new Object is to be added, data for the Object is entered in the fields shown below:

*Object class: User may select one of the following:
    Data Collection Activity
    Fixed Facility with Camouflage
    Fixed Facility without Camouflage
    Mobile Systems with Camouflage
    Mobile Systems without Camouflage

*Object group: User may select from a list of available groups or enter a new group by hitting <Page Up>
    Example: Apache
*Object Name:
    Example: Apache 1 (near treeline)
Object Size (LxWxH in meters):
    Example: 3.6h × 7.6w × 24.4d
*Slant range to Image Collection Platform(meters):
    Example: 750.0
Object Latitude (degrees):
Object Longitude (degrees):
Object Altitude (meters):
*Look angle from Image Collection Platform (degrees):
    Example: 35.0

If Object employs camouflage, the Object's CCD information must also be entered:

CCD Type: Select or <Page Up> to enter new type.
   Example: Net
CCD Identifier: Select or <Page Up> to enter new ID.
   Example: TBE visual/thermal green
Visual Properties:
   Example: Olive green
Thermal Properties:
   Example: Ambient air flow
Radar Properties:
   Example: Radar-scattering carbon filaments
Other Properties:

Otherwise, if the Object selected was an existing Object, the user need only specify the Slantrange and Look angle relative to the Image Collection Platform, which link the Object to the selected Scene record.

When data entry is complete, the Object record is added to the currently opened MSD database, or an error message is displayed on the Message line if an error is encountered during the operation. The Add operation can be aborted at any point during data entry by hitting the <Esc> key.

Adding Data Records

Data records can be introduced into an MSD by selecting **Data** from the Record Selection Menu. Data records are divided into two classes, Ground Truth Data, consisting of Meteorological and Calibration Panel Data, and Physical Data, which includes Chromatic, Gloss Meter, Radiometer, and Spectral Radiometer Data records. Meteorological, Calibration Panel, and Radiometer/Thermistor Data records consist of text files containing micrologger data which must be formatted using the preprocessor utility included with the MSD. Spectral Radiometer data records consist of text files containing filenames of one or multiple such micrologger data files. Gloss Meter and Chromatic Data records consist of text files which can be created using the data entry option of the preprocessor utility, or with any text editor. See the documentation of preproc.exe, the preprocessor, for additional information on using this utility.

Meteorological Data. Meteorological Data are generated by microloggers and must be formatted with preprocessor utility before being added to the MSD database.

A Met Data record can be associated with one or more Site records. The Add Met Data submenu consists of two options, one for adding a new Met record and one for associating an existing record with an additional Site.

Calibration Panel Data. Micrologger Data; must be formatted with preprocessor before entry into MSD.

A Cal Panel record can be associated with one or more Site and Scene records. The Add Cal Panel submenu contains three options, one for adding a new Cal Panel record, one for associating an existing record with an additional Site, and a third for associating the record with a Scene record.

Chromatic Data. Chromatic Data are contained in a text file created with the preprocessor data entry option or text editor from chromatic measurements gathered during data collection effort.

A Chromatic record will have an owner Site record, selected when the record is introduced into the MSD. In addition, the Chromo record may be associated with 0 or more Object records. The Add Chromo submenu will have two options, one for adding a new Chromo record and one for associating an existing record with an additional Object.

Gloss Meter Data. A Gloss Meter Data file is a text file created with preprocessor data entry option or text editor from gloss measurements taken during data collection.

A Gloss Meter record will be owned by exactly one Site record, which is selected when the record is introduced into the MSD. In addition, the Gloss record may be associated with 0 or more Object records. The Add Gloss submenu will have two options, one for adding a new Gloss Meter record, and a second for linking an existing record to an additional Object.

Radiometer/Thermistor Data. Rad/Therm Data are generated by micro-loggers. Rad/Therm files must be properly formatted using the preprocessor utility before being added to the MSD.

A Radiometer/Thermistor record will be owned by exactly one Site record, which is selected when the record is added to the database. In addition, a Rad/Therm record can be owned by 0 or 1 Object records. The Add Rad/Therm submenu will have two options, one for adding a new Rad/Therm Data record, and a second for associating an existing Rad/Therm record with an Object record.

Spectral Radiometer Data. Spectrad Data is contained in multiple files generated by microloggers. The file that is stored in the MSD is actually a file containing the list of filenames in which the Spectral Radiometer data resides. This file list should be generated by an ordinary text editor, or via the preprocessor data entry option.

A Spectral Radiometer record will be owned by exactly one Site record, which is selected when the record is added to the database. In addition, a Spectral record can be associated with 0 or more Object records. The Add Spectrad submenu has two options, one for adding a new Spectrad record, and a second for associating an existing record with a selected Object record.

Deleting a Record

To delete a record from the currently opened MSD, select the **Delete** command from the Database Commands Menu. Next, select the appropriate record type from the Record Selection Menu and follow the instructions below.

Deleting a Data Collection Effort Record

Selecting **DCE** from the Record Selection Menu will allow the user to delete a Data Collection Effort record from the currently opened MSD database. Select the appropriate DCE name and type 'D' at the prompt to delete the record.

Deleting a Site Record

Select **Site** from the Record Selection Menu to delete a Site record from the current MSD. Next, select the appropriate record by Site Name, and type 'D' to delete the record from the database.

Deleting a Scene Record

Choose the **sCene** option to delete a Scene from the MSD. The user may select the Scene record to be deleted either by DCE or by Site Name. The Scene record is selected by first indicating the owner DCE and Site records and finally selecting the Scene record to be deleted from the database. To carry out the operation, type 'D' at the prompt.

Deleting an Images Record

Select **Images** to delete an Images record from the MSD. To indicate the Images record to be deleted, traverse the database hierarchy by selecting the owner DCE, Site, and Scene records, and choose the appropriate Images record by spectrum.

Before completing the delete operation, the user may display the selected Image by typing 'D' at the display prompt. Next, to carry out the delete operation, hit 'D' at the delete prompt. The user will have the option to (C)opy the Image file to a new filename before deleting, or to perform (D)elete only.

Deleting an Object Record

Select **Object** to delete an Object record from the MSD. As above, an Object record may be selected by traversing the currently opened database hierarchy indicating the owner DCE, Site, and Scene records, and then

choosing the Object to be deleted. To carry out the operation, hit 'D' or any other key to abort the transaction.

Deleting a Data Record

Choose the **Data** option to delete Data records from the MSD. Ground Truth and Physical Data records may be selected by record Description. The user will be given the option to (C)opy the Data file to a new filename before deleting the file from the MSD, or to perform the (D)elete operation only.

Querying a Record

To display a record from the currently opened MSD database, select the **Query** command from the Database Commands Menu. Next, select the appropriate record type from the Record Selection Menu and follow the instructions below.

Querying a Data Collection Effort Record

To display the contents of a Data Collection Effort record, simply select the appropriate record by DCE Name.

Querying a Site Record

The contents of a Site record may be displayed by selecting the appropriate record from a list of Site Names in the currently opened MSD.

In addition, the user may browse any Data files associated with the selected site by hitting the <F1> key at the prompt and choosing the file to be browsed.

Querying a Scene Record

Scene record can be queried by DCE or by Site. After choosing the owner DCE and Site records, select the Scene to be displayed and hit <Enter> to display its contents. The user may also browse any Data files associated with this Scene by hitting <F1> at the prompt.

18

Querying an Images Record

An Images record can be queried by DCE, by Site, or by indicating Objects contained in the Image. To query an Images record by Object(s), select one or more Objects from a list of available Objects by using the <Space> key. The user will then be presented with a list of Scenes containing these Objects, and upon selection of the Scene, the available image spectrum types for the Scene are presented. Selecting the desired spectrum will allow the user to view the corresponding Image.

Alternatively, the user may choose an Image to be displayed by first selecting the owner DCE, Site, and Scene records and then indicating the appropriate spectrum.

The user will also have the option to write the currently selected Image to the MSD View file for quick retrieval using the **View** function discussed below.

Querying an Object Record

An Object record can be queried by traversing the database hierarchy, selecting the owner DCE, Site, and Scene records. Next, select the Object record to be displayed. Data records associated with the selected Object can be browsed by hitting the <F1> function key.

Querying a Data Record

Performing a Query operation on Physical and Ground Truth Data records allows the user to browse the text files containing the data measurements. After selecting the appropriate file and entering the browser, the cursor keys can be used to navigate through the textfile, and the <Esc> key to exit the browser back into the MSD command interface.

Viewing an Image

Selecting the **View** command from the Database Commands Menu enables the user to quickly view Images which have been introduced into the MSD View file viewimgs.dat. Images are written to this file through the Query Images function described above, and can subsequently be selected by Scene Name and Spectrum type for display through this View function.

In addition, the View function allows a selected Image to be written to an output file, so that the Image can be exported (in TIFF format) from the MSD.

Preprocessor Utility

The file preproc.exe is a preprocessing utility for formatting physical and ground truth data for entry into the MSD. All Meteorological, Calibration Panel, and Radiometer/Thermistor data files must first be formatted by this utility prior to introduction into the MSD. In addition, the preprocessor also includes data entry routines for creating Chromatic and Gloss Meter data files and to start the preprocessor, type PREPROC.EXE from the DOS command prompt.

Main Menu

a. *Concatenate multiple files into one.* This function accepts a list of input filenames and an output filename and creates an output file consisting of the contents of the input files concatenated together. The user selects from the file list the files to be concatenated. Each file selected appears in the list at the top of the screen. When all desired files are selected, hitting <ESC> will prompt the user for the name of the output file. This file will contain the concatenated contents of the selected input files.

b. *Generate micrologger file with common Ids.* All micrologger files (including meteorological, calibration panel, and radiometer/thermistor files) must be processed using this option before being introduced into an MSD. Raw micrologger data files consist of multiple rows of values separated by commas. The first three values in each row are record ID, julian day, and time fields, respectively. The remaining fields will vary depending upon the micrologger file type.

The purpose of this option is to generate a file which consists of only those micrologger records with a selected record ID. In addition, this function includes a header with each output file consisting of the number of rows, the number of columns, and the names of each field in the record, as defined by the user.

To process a micrologger file, select an input file from the file list and press <ENTER>. Next, hit <ESC>. The user will then be asked for an output filename. After a valid filename is entered, the program will then sort the records and display a list of all record ID's contained in the input file, prompting the user for a record ID. Finally, the user is then asked to specify the name of the fields present in the file (starting with field 4, as fields 1-3 are the same for all file types).

c. *Create gloss meter/chromatic/spectral radiometer data file.* This option brings up the data entry menu, to be described below.

d. *Quit.* Exit preprocessor and return to DOS.

Data Entry Menu

The purpose of the Data Entry function is to allow the user to enter data from gloss meter, chromatic, and spectral radiometer measurements into a formatted text file, which can then be introduced into the MSD. By selecting options 1-3 from this menu, the user will be prompted for an output filename and the date on which the data collection was performed. Next, the data input form for the selected record type will appear on the screen.

    a. *Create Gloss Meter Data File.* Gloss meter data consists of from one to four separate values for both 20-deg and 60-deg measurements, along with a description of items from which gloss meter data was collected (e.g., "olive green from rotor blade of Apache").

The user enters the data into the appropriate input fields, and hits <F1> to accept the current record, which is then written to the output file. When all data has been entered, <F10> is hit to indicate the end of the input, and the output file is closed. Once an output file is closed, it cannot be reopened for editing through the preprocessor (although, because it is an ordinary text file, it can be modified with any text editor).

IMPORTANT: Be sure to press <ENTER> after entering a value into each input field! If <ENTER> is not pressed, the contents of an input field will not be accepted. In addition, an empty description field will not be accepted by the data entry utility. If <F1> is pressed and nothing happens, check the description field and make sure it is not empty and that input was terminated by hitting <ENTER>. Lastly, any numerical fields left blank will be assumed to contain the value 0.0.

    b. *Create Chromatic Data File.* Chromatic data consist of a description and three numerical values, (Y x y) for each data sample. After entering the data into the appropriate fields, <F1> writes the data to the output file and readies the input fields for the next sample, and <F10> indicates the end of the input data. Again, only a nonempty description will be accepted, and an unspecified value for Y, x, or y will be assumed 0.

    c. *Create Spectral Radiometer Data File.* Spectral radiometer data from a data collection will be contained in multiple files, one per sample. The file that is entered into an MSD will consist of a list of these filenames, along with their corresponding descriptions. The filename and description of each spectral radiometer sample, along with the sensor head type with which the measurements were made (UV for ultraviolet and WB for wide-band) are written to the output file by way of this data entry form.

    d. *Exit/Previous Menu.* Return to main menu.

File Browser

To display the contents of physical and ground truth data files, the MSD software makes calls to the file browser <u>browse.com</u> which is located in the MSD root directory. The user can navigate a data file from within the browser with the cursor keys and the <Page Up>, <Page Down>, <Home>, and <End> keys. To exit the browser and return to the MSD command interface, hit the <Esc> key.

4   File Descriptions

Below are descriptions of each of the files that may be created during execution of the MSD software.

The following file is created in the MSD root directory upon initiation of the MSD software:

dbs_errs.log Log file to which all database errors are written

This log file is created by the MSD software if it does not already exist. If it does exist, error messages are appended to the end of the file; therefore, the size of this file will continue to increase as error messages are written to it. This file should be deleted on a regular basis to control its size.

The environment variables, DBTAF and DBLOG, are set by the MSD software to the MSD root directory so that the transaction activity file and the database log file, respectively, will be created in that directory. These files are created upon initiation of the MSD software because transaction processing is used by the MSD software:

vista.taf   Transaction activity file used for automatic database recovery
dbquery.log Database log file used for automatic database recovery

These transaction processing files are created and maintained by Raima Data Manager. These files should not be deleted! Transaction processing is used in the MSD software to maintain the logical consistency of the database by allowing multiple, related updates to be grouped together and then written to the database as a unit at the end of the transaction. Either all of the updates will be made to the database successfully or none of the updates will be made. For example, if an OBJECT with CCD is added to the database and the OBJECT record is created successfully but an error occurs creating the CCD record, then the transaction will be aborted and neither of the records will be created. This process leaves the database in a consistent state.

The environment variable QDFPATH is set by the MSD software to the MSD root directory so that the data and key files for the db_QUERY temporary sort database (DB_QUERY.DBD) will be created in that directory. These files are created when an MSD is opened:

db_query.qsd	Temporary sort data file
db_query.qsk	Temporary sort key file
db_query.qgd	Temporary group data file
db_query.qgk	Temporary group key file

These database files are temporary; they are created by Raima Data Manager when a database is opened, and they are deleted when the database is closed. However, if an RDM error occurs, these files may not be deleted by RDM. In this case, the user can delete the files.

The following subdirectory file is created in the directory specified by the user at run-time when a new database is created:

<database_name>.DDD

For example, if a database named "APDI" was created, the following subdirectory would be created in the MSD root directory (e.g., C:\MSD):

C:\MSD\APDI.DDD

There can be multiple MSD databases containing data collected from different Data Collection Efforts. However, the MSD software does NOT allow queries to be made across multiple databases. With this in mind, be careful in selecting how to partition your data into separate databases. Also note that in general, the larger the database, the slower the response time when querying the database.

The environment variable DBFPATH is set by the MSD software to the database subdirectory so that all of the database data and key files defined in the MSD DDL specification will be created in that subdirectory when a new database is created. Those data and key files are listed below:

ddceffrt.dat	**cd_ccdid.dat**
dsite.dat	**cd_spect.dat**
dscene.dat	**kdcename.key**
dimages.dat	**kmisc.key**
dscenobj.dat	**ksite.key**
dobject.dat	**kobjclas.key**
dccd.dat	**kobjgrp.key**
dmetdata.dat	**kobjname.key**
dcalpanl.dat	**kccdtype.key**
dgloss.dat	**kccdid.key**
dspectrd.dat	**kscndesc.key**
dchromo.dat	**kdatecap.key**
dradthm.dat	**kseason.key**
cd_site.dat	**ksceneid.key**
cd_objcl.dat	**kmetdesc.key**
cd_objgr.dat	**kcaldesc.key**
cd_ccdtp.dat	**kchrdesc.key**

24

kglsdesc.key
kspcdesc.key
kraddesc.key

The following file is created in the MSD root directory upon addition of the first SCENE record to any MSD:

imagedbs.sys Binary file used to store unique ID's associated with
SCENE's (across all MSD databases)

When a new Scene is added to an MSD, a unique "Scene ID" is retrieved from this file and the Scene ID in this file is incremented by 1. This Scene ID is later used to create unique image filenames when IMAGES associated with a SCENE are added to an MSD. The "Scene ID" is not stored as data within an MSD, because it is used to store UNIQUE ID's for SCENE records across "all" MSD. This file should NOT be deleted.

The following file is created in the Images directory upon addition of an IMAGES record to an MSD:

<image_filename>.tif   Image file in TIFF format associated with an
IMAGES record in an MSD.

This file is copied from the input image file entered by the user to the Images directory. This file should NOT be deleted.

The following "View file" is created in the MSD root directory the first time a user chooses to write Image data for an Image being queried to this view file:

viewimgs.dat Binary file containing a list of Images that can be viewed
(displayed) using the VIEW operation.

This file contains a scene description, the spectrum in which the Image was captured, the volume where the image is stored, and the image filename for each image written to it. This file can be deleted anytime.

The following file is created in an MSD subdirectory upon addition of a MET_DATA record to an MSD:

METnnnnn.MET   Text file containing Meteorological Data associated
with a MET_DATA record in an MSD.

This file is copied from the input Met Data filename entered by the user to the database subdirectory (e.g., \APDI.DDD) and assigned a unique filename for that database. The **nnnnn** portion of the filename is a 5-digit number (beginning with 00001) unique to all MET DATA files in that database sub-directory. Met Data files are created from microloggers and MUST be formatted properly using the preprocessor provided before being added to an

MSD. Details on using the preprocessor can be found in the text file PREPROC.DOC in the PREPROC directory. This file should NOT be deleted.

The following file is created in an MSD subdirectory upon addition of a CAL_PANEL_DATA record to an MSD:

CALnnnnn.CAL   Text file containing Calibration Panel Data associated with a CAL_PANEL_DATA record in an MSD.

This file is copied from the input Cal Panel Data filename entered by the user to the database subdirectory (e.g., \APDI.DDD) and assigned a unique filename for that database. The **nnnnn** portion of the filename is a five-digit number (beginning with 00001) unique to all CAL PANEL DATA files in that database subdirectory. Calibration Panel Data files are created from microloggers and MUST be formatted properly using the preprocessor provided before being added to an MSD database. Details on using the preprocessor can be found in the text file PREPROC.DOC in the PREPROC directory. NOTE that a CAL_PANEL_DATA file should contain the data for all 3 cal_panels (low, medium, and high emissivity) if they were all used. This file should NOT be deleted.

The following file is created in an MSD subdirectory upon addition of a RADIOMETER/THERMISTOR DATA (RAD_THERM_DATA) record to an MSD database:

RADnnnnn.RAD   Text file containing Radiometer/Thermistor Data associated with a RAD_THERM_DATA record in an MSD database.

This file is copied from the input Rad/Therm Data filename entered by the user to the database subdirectory (e.g., \APDI.DDD) and assigned a unique filename for that database. The **nnnnn** portion of the filename is a five-digit number (beginning with 00001) unique to all RADIOMETER/THERMISTOR DATA files in that database subdirectory. Radiometer/Thermistor Data files are created from microloggers and MUST be formatted properly using the preprocessor provided before being added to an MSD database. Details on using the preprocessor can be found in the text file PREPROC.DOC in the PREPROC directory. This file should NOT be deleted.

The following file is created in an MSD subdirectory upon addition of a GLOSS_DATA record to an MSD:

GLOnnnnn.GLO   Text file containing Gloss Meter Data associated with a GLOSS_DATA record in an MSD.

This file is copied from the input Gloss Data filename entered by the user to the database subdirectory (e.g., \APDI.DDD) and assigned a unique filename for that database. The **nnnnn** portion of the filename is a five-digit number (beginning with 00001) unique to all GLOSS DATA files in that database

26

subdirectory. Gloss Meter Data ares recorded to Gloss Meter forms during data collection and MUST be formatted properly using the preprocessor provided before being added to an MSD database. Details on using the preprocessor can be found in the text file PREPROC.DOC in the PREPROC directory. This file should NOT be deleted.

The following file is created in an MSD database subdirectory upon addition of a SPECTRAL RADIOMETER DATA (SPECTRAD_DATA) record to an MSD:

SPEnnnnn.SPE   Text file containing Spectral Radiometer Data filenames associated with a SPECTRAD_DATA record in an MSD.

This file is copied from the input Spectral Radiometer Data filename entered by the user to the database subdirectory (e.g., \APDI.DDD) and assigned a unique filename for that database. The **nnnnn** portion of the filename is a five-digit number (beginning with 00001) unique to all SPECTRAL RADIOMETER DATA files in that database subdirectory. Spectral Radiometer Data are written to files whose filenames MUST be entered using the preprocessor provided before being added to an MSD database. Details on using the preprocessor can be found in the text file PREPROC.DOC in the PREPROC directory. This file should NOT be deleted.

The following file is created in an MSD subdirectory upon addition of a CHROMATIC DATA (CHROMO_DATA) record to an MSD database:

CHRnnnnn.CHR   Text file containing Chromatic Data associated with a CHROMO_DATA record in an MSD.

This file is copied from the input Chromo Data filename entered by the user to the database subdirectory (e.g., \APDI.DDD) and assigned a unique filename for that database. The **nnnnn** portion of the filename is a five-digit number (beginning with 00001) unique to all CHROMO DATA files in that database subdirectory. Chromo Data are written to printouts and MUST be formatted properly using the preprocessor provided before being added to an MSD. Details on using the preprocessor can be found in the text file PREPROC.DOC in the PREPROC directory. This file should NOT be deleted.

5 Error Messages

The following section contains a description of all error messages that may be displayed by the MSD software.

101: Error initializing database files.
Raima has returned an error code while attempting to initialize the database files when creating a new MSD. See the error log file dbs_errs.log in the MSD root directory for a description of the error.

102: Error opening database files...See System Administrator.
Raima has returned an error message in attempting to open MSD. See error log file dbs_errs.log for a description of the error.

103: Error creating database directory...See System Administrator.
MKDIR command failed in attempting to create database directory (.DDD) in the current data path.

104: Error copying file -- access denied.
DOS returned ACCESS DENIED error in attempting a file copy operation on an Image or Physical/Ground truth data file.

105: Error creating destination file -- directory full.
DOS reports an attempt to copy Image or Physical/Ground Truth data file into full directory.

106: Error...insufficient space.
Insufficient space on destination disk to create Image or Physical/Ground Truth data file.

107: Error finding drive.
Images are stored on the last drive (which should always be the optical drive).

108: Incorrect volume inserted...check volume name.
The volume name of the last drive does not match the volume name stored for the Images record.

109:     Error creating (record type) filename.
         Attempt to create Image or Physical/Ground Truth Data file has
         failed.

110:     Path does not exist.
         Attempt to set MSD data path to a path name which does not
         exist, or to copy a file to a nonexistent destination path.

111:     Error changing the file protection on file.
         DOS function chmod reports an error changing file permissions.

112:     Error copying file -- invalid file handle.
         DOS reports an invalid file handle in performing file copy
         operation.

113:     Error copying file.
         DOS reports an error copying file.

114:     Error deleting file -- read-only file.
         Attempt to delete a file without write permission.

115:     Error deleting file.
         DOS reports an error deleting file.

116:     Error -- file not found.
         If this error is encountered while attempting to add an new Image
         or Ground/Physical Data file, check that the file exists and the file
         specification was entered correctly. If the error occurs during a
         Query, however, it could be serious! It could mean that an Image
         or Data file previously added to a database were inadvertently
         deleted.

117:     Error -- file already exists.
         A file of the same name already exists in the target directory.

118:     Error -- too many open file handles.
         The maximum number of file handles has been reached. See DOS
         and Microsoft C 6.0 documentation for increasing the number of
         available file handles.

119:     Error creating file.
         DOS reports an error creating file.

120:     Error opening source file.
         DOS reports an error opening source file.

121:     Error...invalid TIFF file.
         Image file is not in TIFF format, or is corrupted.

122: VESA mode 0x101 is not supported.
Host computer does not support graphics mode required by MSD for image display.

123: Error creating error log file.
DOS reports an error creating the error log file, dbs_errs.log , which is located in the MSD root directory.

124: Error getting Scene ID from System file...See System Administrator.
The MSD System file, imagedbs.sys, is created in the MSD root directory upon addition of first Scene record of ANY MSD database. This file is used to store unique Scene ID's across all databases. (For a more detailed description of this file, see Chapter 4 of this Document, File Descriptions).

125: Error opening/creating View file -- viewimgs.dat.
DOS reports an error opening or creating viewimgs.dat, which is located in the MSD root directory.

126: Error reading from View file.
DOS reports an error reading from the View file, viewimgs.dat.

127: Error writing to View file.
DOS reports an error writing to the Image View file, viewimgs.dat.

128: NO Images data in the View file -- Select QUERY command first.
MSD View file, viewimgs.dat, does not contain any images. To add an image to the View file, execute a Query function on the image. Upon completion of a Query, the user will be allowed to add the image to the View file.

201: Error beginning new transaction to (add/delete) record.
Raima reports an error beginning a new transaction.

202: Error ending transaction...record not (added/deleted).
Raima reports an error during an add/delete operation which causes the transaction to be aborted. See error log file, dbs_errs.log, for possible cause. Also, check available space on destination disk where MSD files reside.

301: Error adding record -- duplicate key.
Attempt to add two records to an MSD with a duplicate key field.

302: Error adding record to database...See system administrator.
Raima reports an error adding record to database. See error log file, dbs_errs.log, for possible cause.

30

303: Error associating (record type 1) record with (record type 2).
Raima reports an error forming link between (record type 1) and (record type 2). Check MSD error log file, dbs_errs.log, for possible cause.

304: Selected (record type 1) record already associated with (record type 2).
Record of type 1 can be associated with at most one record of type 2. For example, a Radtherm data record can be owned by at most one Object record. An attempt to associate a Radtherm record which is already owned by an Object with another Object will result in the above error message.

305: Error creating analog data name.
Error creating analog data name for Images record. Check MSD error log file, dbs_errs.log, for possible cause.

401: No (record type) record found.
No records were found in the MSD of the selected record type.

402: Error getting (record type) record.
Raima returned error getting record. See error log file, dbs_errs.log.

403: Error finding first (record type 1) record for (record type 2) record.
Raima system error returned from d_findfm in attempting to find the first member record of (record type 1). See MSD error log file, dbs_errs.log, for possible cause.

404: Error executing file browser.
DOS call system() returns an error trying to execute file browser.

405: Error checking (record type 1) record for owner (record type 2) record.
Raima system error checking record for owner. See MSD error log file, dbs_errs.log, for possible cause.

406: Error setting owner of (Set).
Raima system error setting owner of set. See error log file dbs_errs.log.

407: Error getting owner records...See System Administrator.
Raima returns error getting owner records of current record. See MSD error log file, dbs_errs.log.

408: No (record type 1) record owned by this (record type 2) record.
In the database hierarchy, the current record has no member records of the specified record type.

409: Error checking for member (record type) records.
Raima returns error checking for member records of (record type) for current record.

410: Error getting count of members of (Set).
Raima function d_members() returns error getting count of current set members. Check MSD error log file, dbs_errs.log.

411: No available spectrums for this Scene.
Attempt to add an Images record to a Scene when there already exists an Image record for each valid spectrum type.

412: Error getting available spectrums for this Scene.
MSD was unable to retrieve available spectrums for current Scene. Check MSD error log file, dbs_errs.log.

501: Error deleting (record type) record.
Raima encountered an error deleting record. Check MSD error log file, dbs_errs.log.

502: Record cannot be deleted...delete member (record type) record(s) first.
User attempted to delete a DCE, Site, or Scene record which has member records. These member records must be deleted before the record can be deleted. For example, before a DCE record can be deleted, all member Site records must first be deleted. Similarly, member Scenes must be deleted from a Site record before the Site record can itself be deleted, and member Images before a Scene can be deleted.

503: Error disconnecting (record type 1) record from (record type 2) record.
Raima reports an error disconnecting link between (record type 1) record and (record type 2) record. Check MSD error log file for cause.

601: Error allocating memory for (record type) records...See System Administrator.
DOS reports an error allocating memory for the indicated record type. Likely caused by insufficient memory available for record list.

602: Not enough memory to execute file browser.
The MSD software invokes the stand-alone file browser by way of the DOS system call. If this error is encountered, try rebooting computer with TSR programs removed from boot configuration.

701: No valid codelist values...See System Administrator.
Check MSD error log file.

32

702:    No available codelist values...See System Administrator.
        Check MSD error log file.

703:    Error adding (codelist record type) codelist record -- exceeds
        65,535 records.
        There can be a maximum of 65,535 codelist records in any code-
        list. Further attempts to add a new record to the codelist will
        result in the above error.

704:    No corresponding codelist records...See System Administrator.
        No corresponding codelist record for given code number. Check
        MSD error log file for possible cause.

705:    Error getting codelist values.
        Raima reports error retrieving codelist values. Check MSD error
        log file.

706:    Invalid spectrum codenum.
        Codenum does not correspond to one of the predefined Image
        spectra.

6   Data Forms

Data Forms have been provided to aid in gathering data both during and after the Data Collection Effort. Following is a complete list of data forms provided. These forms can be found in **Appendix A.** **Appendix B** describes the data collection equipment requirements for this effort.

a.   Data Collection Effort.

b.   Area of Interest.

c.   Scene/Images.

d.   Object.

e.   Scene/Objects.

f.   Video Data.

g.   Print/Slide Data.

h.   Print/Slide Gps Data.

i.   Meteorological Data.

j.   Calibration Panel Data.

k.   Radiometer & Thermistor Data.

l.   Gloss Meter Data.

m.   Spectral Radiometer Data.

n.   Chromatic Data.

Actions to Complete BEFORE the Data Collection Effort

NOTE: For all data collection efforts, all team members should be familiar with how to complete the Data Forms in which they will be responsible BEFORE the Data Collection Effort begins.

a. *Data Collection Effort.* The Data Collection Effort name should be decided as soon as possible because it will be used throughout the data collection reporting process. The begin and end dates, however, may not yet be known and therefore may be completed later.

b. *Area of Interest.* If the Areas of Interest / Sites in which data are going to be collected are known, then complete this form(s). "DCE Area #"s should be assigned to each Area of Interest; these numbers will be used throughout the data collection reporting process. Areas of Interest may be partitioned in different ways; that is, one Site may correlate to one Area of Interest or there may be two or more Areas of Interest within a Site. It is important that during the Data Collection Effort, the "DCE Area #"s associated with the Areas of Interest be used consistently on all Data Forms. The begin and end dates, however, may not yet be known and therefore may be completed later.

c. *Scene/Images.* No actions required.

d. *Object.* No action required.

e. *Scene/Objects.* No action required.

f. *Video Data.* Label as many video tapes (both VHS and 8mm if necessary) as may be needed with a temporary label as follows (depending upon the spectrum in which the data of the tape will be captured):

> VISUAL #<#> or
> IR3-5 #<#> or
> IR8-12 #<#> or
> LowLight #<#>

The label should appear on both the tape and the tape case and should be designated as an "Original." The number portion of the label name should be duplicated for the same data in different spectrums; however, the number should be unique (beginning with "1" for sets of data that are not the same). For example, if video data were collected from 10:00 to 12:00 in three spectrums, there would be three tapes labeled "VISUAL #1," "IR3-5 #1," and "IR8-12 #1;" then if video data were collected from 2:00 to 4:00 in two spectrums, there would be two tapes labeled "VISUAL #2" and "IR8-12 #2." All other data associated with these video tapes (e.g., date, times, etc.) will be

logged on the <u>Video Data</u> form and transferred to permanent labels after the Data Collection Effort is complete.

g. *Print/Slide Data.* Label as many rolls of film (both 35mm and medium format) as may be needed as follows:

> PRINT/SLIDE DATA
> ROLL #<#>

The number portion of the label should be a unique number beginning with "1" (e.g., "ROLL #1," "ROLL #2," etc.). Only one roll of film will be placed in each baggie during data collection. All other data associated with these rolls of film (date, spectrum, etc.) will be logged on the <u>PRINT / SLIDE DATA</u> form during the Data Collection Effort.

h. *Print / Slide Gps Data.* No action required.

i. *Meteorological Data.* Label as many diskettes as may be needed to store meteorological data files with a label as follows:

> METEOROLOGICAL DATA for
> <Data Collection Effort Name>
> <month> <year>

j. *Calibration Panel Data.* Label as many diskettes as may be needed to store calibration panel data files with a label as follows:

> CALIBRATION PANEL DATA for
> <Data Collection Effort Name>
> <month> <year>

k. *Radiometer & Thermistor Data.* Label as many diskettes as may be needed to store radiometer and thermistor data files with a label as follows:

> RADIOMETER & THERMISTOR DATA for
> <Data Collection Effort Name>
> <month> <year>

l. *Gloss Meter Data.* No action required.

m. *Spectral Radiometer Data.* Label as follows:

> SPECTRAL RADIOMETER DATA for
> <Data Collection Effort Name>

Label as many spectral radiometer tapes as may be needed to store spectral radiometer data as follows:

TAPE #<#>

The number portion of the label should be a unique number beginning with "1" (e.g., "TAPE #1," "TAPE #2," etc.). All other data associated with these spectral radiometer tapes (date, descriptions of readings, etc.) will be logged on the SPECTRAL RADIOMETER DATA form during the Data Collection Effort.

n. Chromatic Data. Label folders for as many printouts of chromatic data as may be needed as follows:

CHROMATIC DATA
BAG #<#>

The number portion of the label should be a unique number beginning with "1" (e.g., "BAG #1," "BAG #2," etc.). Only one chromatic data printout will be placed in each folder during data collection. All other data associated with these chromatic data printouts (date, descriptions of readings, etc.) will be logged on the CHROMATIC DATA form during the Data Collection Effort.

Actions to Complete DURING the Data Collection Effort

NOTE: Each data form has a Data Form Description to aid in gathering the correct information for the form.

a. Data Collection Effort. Update this form by adding or updating it with the correct begin and end dates, if necessary.

b. Area of Interest. If this form has been completed for all Areas of Interest, then update it with the correct begin and end dates, if necessary. If not, then complete this form as the Areas of Interest become known. "DCE Area #'s" should be assigned to each Area of Interest as soon as possible, because these numbers will also be used throughout the data collection reporting process. Areas of Interest may be partitioned in different ways; that is, one Site may correlate to one Area of Interest or there may be two or more Areas of Interest within a Site. It is important that during the Data Collection Effort, the "DCE Area #'s" associated with the Areas of Interest be used consistently on all Data Forms.

c. Scene/Images. This form cannot be completed until AFTER the Data Collection Effort when specific scenes are selected from the data set for entry into the MSD.

d. *Object.* This form should be completed for each Object for which data (including video, print/slide, physical, ground truth data) are collected at each Area of Interest.

e. *Scene/Objects.* This form cannot be completed until AFTER the Data Collection Effort when specific scenes are selected from the data set for entry into the MSD database.

f. *Video Data.* Verify that clocks on all recording devices are in sync. Verify that the collection of GPS data is working properly. Use tapes that are labeled appropriately in the different recorders; that is, tapes used consecutively should have the same label #'s. For example, if the tape used in the Visual recorder is labeled "VISUAL #1," then the tape used in the IR 8-12 recorder should be labeled "IR8-12 #1." Complete this form before the video data are actually collected, with the exception of the "TO TIME" column which may be logged after the video data are collected. A separate form should be completed for each Area of Interest.

g. *Print/Slide Data.* After each roll of print/slide film is taken, place the roll of film into one of the prelabeled "PRINT/SLIDE DATA" containers. Note the ROLL # on the container. Complete this form. As an extra precaution, the roll # could be also copied to the film canister. Also note instructions on <u>PRINT/SLIDE GPS DATA</u> form. A separate form should be completed for each Area of Interest.

h. *Print/Slide Gps Data.* Complete this form when taking print/slide data for correlation with GPS positional information. It is pertinent that this form be completed for each exposure on each roll of film in which GPS positional information is necessary. GPS positional information is optional data that can be stored with an image in the Multispectral Signatures Database; however, GPS positional information is REQUIRED for accurate image analysis. A separate form should be completed for each Area of Interest.

i. *Meteorological Data.* Verify operation of meteorological data micrologger station and sensors. After Met Data have been collected and are ready to be downloaded to the PC, create a download file with a unique filename (which will be used on this form). Then download the Met Data from the micrologger to the PC. After data are downloaded to the PC, complete this form. Copy the Met Data file to the diskette prelabeled for Met Data.

j. *Calibration Panel Data.* Verify operation of calibration panel data micrologger station and sensors. After Cal Panel Data have been collected and are ready to be downloaded to the PC, create a download file with a unique filename (which will be used on this form). Then download the Cal Panel Data from the micrologger to the PC. If another calibration panel data micrologger station is logging data for

other calibration panels for the same Area of Interest, the cal panel data from the other cal panel data micrologger station will also be downloaded to the PC. In this case, when more than one micrologger is used for multiple cal panels in the same Area of Interest, be sure to assign UNIQUE filenames to both cal panel data files. After data are downloaded to the PC, complete this form. If another calibration panel data micrologger station is logging data for other calibration panels for the same Area of Interest, note the micrologger set # on this form and complete a separate Cal Panel Data form for that micrologger set #. Copy the Cal Panel Data file(s) to the diskette prelabeled for Cal Panel Data.

k. *Radiometer & Thermistor Data.* Verify operation of radiometer/ thermistor micrologger station and sensors. Complete this form before collecting the rad/therm data with the exception of the "download filename." After the Rad/Therm Data have been collected and are ready to be downloaded to the PC, create a download file with a unique filename (which will be used on this form). Then download the Rad/ Therm Data from the micrologger to the PC. After data are downloaded to the PC, update this form with the name of the download file created. Copy the Rad/Therm Data file to the diskette prelabeled for Rad/Therm Data. A separate form should be completed for each Area of Interest.

l. *Gloss Meter Data.* Complete this form while collecting the Gloss Meter data. A separate form should be completed for each Area of Interest.

m. *Spectral Radiometer Data.* Insert a blank spectral radiometer tape on Side A and collect data for the Wide-Band Sensor. Note the tape # used on this form (Side A). Complete this form (Side A). Insert the same spectral radiometer tape on Side B and collect data for the Ultra-violet Sensor. Note the tape # used on this form (Side B). Complete this form (Side B). A separate form should be completed for each Area of Interest.

n. *Chromatic Data.* Reset Chromameter so that sample numbers will begin at 1. Complete this form while collecting the chromameter data with the exception of the Bag Label #. A separate form should be completed for each Area of Interest.

Actions to Complete AFTER the Data Collection Effort

General Notes:

Put all forms together in a master binder. Label this binder as follows:

MASTER BINDER FOR
<Data_Collection_Effort_Name>
<Begin_Date_of_DCE> - <End_Date_of_DCE>

Also place site and area maps for all Sites in which data were collected.

NOTE: If there are a lot of data, data can be separated by Sites and multiple binders could be used for each Site; in this case, the Site Name should be included after the Data Collection Effort Name on the binder label as follows:

MASTER BINDER FOR
<Data_Collection_Effort_Name>
<Site_Name>
<Begin_Date_of_Site> - <End_Date_of_Site>

The Master Binder should include a Table of Contents and index labels should be used to separate each section.

a. *Data Collection Effort.* No processing required. Form(s) have been completed.

b. *Area of Interest.* No processing required. Form(s) have been completed.

c. *Scene/Images.* No processing required. Form(s) to be completed later.

d. *Object.* No processing required.. Form(s) have been completed.

e. *Scene/Objects.* No processing required. Form(s) to be completed later.

f. *Video Data.* Form(s) have been completed. The temporary labels on both the video tapes AND the tape cases should be replaced by permanent labels formatted as follows:

ORIGINAL
<Data_Collection_Effort_Name>
<Site_Names>
(in order in which video data were collected)
<Date>/<Begin_Time> - <End_Time>
<Spectrum>

Organize video tapes of the same area-of-intererest but different spectrums together. Place video tapes in location designated for this Data Collection Effort.

g. *Print/Slide Data.* Form(s) have been completed. Film must be sent for processing. Before film is sent out for processing:

Slides:

40

Text can be added to the slide frame during processing (must the same text for all exposures in a roll). The text should include: 1) site name, 2) date (month, year), and 3) roll#.

Prints:

Instructions should include --> Prints processed MUST be returned such that all exposures from each roll of film are together, and the roll # MUST be denoted on each set of exposures.

When film is returned from processing:

Slides:

Place slides in slide binder sleeves for inclusion in the SLIDES binder described below.

Prints:

The following information should be placed on the back of each print:

Roll #
Site Name
Date

- Put all prints/slides in one or more binders, separated by Site Name. Label each binder as follows:

PRINTS <and/or> SLIDES FOR
<Data_Collection_Effort_Name>
<Site_Name>
<Begin_Date_of_Site> - <End_Date_of_Site>
BOOK n OF n

If more than one binder is needed per Site, label the binder # (BOOK n OF n).

h. *Print/Slide Gps Data.* No processing required. Form(s) have been completed.

i. *Meteorological Data.* Form(s) have been completed. Place diskettes in diskette binder sleeves and insert into appropriate location in the Master Binder.

j. *Calibration Panel Data.* Form(s) have been completed. Place diskettes in diskette binder sleeves and insert into appropriate location in the Master Binder.

k. *Radiometer & Thermistor Data.* Form(s) have been completed. Place diskettes in diskette binder sleeves and insert into appropriate location in the Master Binder.

l. *Gloss Meter Data.* Form(s) have been completed.

m. Spectral Radiometer Data. Form(s) have been completed. Place spectral radiometer tapes in location designated for this Data Collection Effort.

n. Chromatic Data. Form(s) have been completed. Place chromameter printouts in binder sleeve and insert into appropriate location in the Master Binder.

Actions to Complete BEFORE Data Entry into the MSD

- Select scenes from prints/slides or video to include in an MSD database.

- Digitize selected scenes into TIFF 24-bit RGB uncompressed format.

- Also digitize (scan) all or portion of the site map for each Site (to clarify references to boresight azimuths in SCENE records). A "Site Map" image should be added to the MSD for each Site of each Data Collection Effort.

- All data forms should have already been completed with the exception of the following two. Complete these forms now for each SCENE selected:

  a. Scene/Images

  b. Scene/Objects

- Data files should be created using the preprocessor, PREPROC.EXE, provided with the MSD.

- Any graphs that are generated from the ground and physical data or other miscellaneous printouts should be stored in the Master Binder.

- When an image is added to an MSD, an analog data name is assigned to that Scene. If the image was digitized from a print or slide, label the print or slide in the PRINTS/ SLIDES binder with the analog data name that was assigned to it. This analog data name can be used to find the print or slide later.

  NOTE: Replace print/slides or video in their appropriate locations after they have been digitized and labeled with the appropriate analog data name.

7 Formatting Data Files

Before entry into the MSD, all physical and ground truth data files must be in proper format. MET, CAL PANEL, and RADIOMETER/THERMISTOR data files are created from microloggers and must be formatted using the pre-processor utility PREPROC.EXE. CHROMO and GLOSS METER data files are hand recorded on the data forms provided and must be saved to text files via the preprocessor data entry routines or a text editor before being introduced into the database. SPECTRAL RADIOMETER data are recorded on tapes and should be written to PC files, one file per sample, whose filenames must be entered via the preprocessor data entry function or a text editor. The resulting file of these filenames will be entered into the database.

Details on using the preprocessor can be found in the text file PREPROC.DOC in the PREPROC directory.

8 Analog Data Format

An analog data name is assigned by the MSD software and stored in the database for each image that is added to the database. This name designates what types of analog data are available and the location of that data. Analog data are captured from different types of media and produced in the forms of slides, prints, and/or video. This analog data name can be useful in locating images (both analog and digital) that have been added to an MSD database. The analog data name consists of a 30-character field as denoted below:

<scene_id>   - S P V - Y Y Y Y M M D D - <dbs_name>

- -

For example:

    00000035-XXV-19921006-REFORG92
    00000026-XPX-19910815-APDI91

The table below describes the format of the analog data name on a column-by-column basis:

Columns	Description
1 - 8	Scene ID (unique number assigned to each scene)
9	Hyphen Separator
10	S if a Slide exists for this image; X, otherwise
11	P if a Print exists for this image; X, otherwise
12	V is this image can be found in a Video; X, otherwise
13	Hyphen Separator
14 - 21	The date this image was captured (YYYYMMDD)
22	Hyphen Separator
23 - 30	MSD name where image was added

There are several uses of the analog data name as described below:

a. From the MSD, the analog data name could be used to identify what forms of analog data exist for a particular image (using SPV portion of the analog data name) and to identify the binder that contains the associated analog data (using other information stored in the database about a particular image such as the Data Collection Effort Name, the Site Name, and the Date; binders will be labeled accordingly).

b. Given a print or slide that has been tagged with the appropriate analog data name, one could find the corresponding image in the image database (using the Database Name portion of the analog data name to know which database to query; then using the Data Collection Effort name, the Site Name, and the Date from the label of the binder that the slide or print was associated with to narrow down the query; then using either the complete analog data name to find the specific IMAGES record or using just the scene_id portion of the analog data name to find the associated SCENE record and all corresponding IMAGES for that SCENE).

c. The analog data name could also be used to at least narrow the search of where to replace a slide or print that has been taken from its binder (using the date and matching the analog data name on the print or slide to an empty slot in a binder with that same analog data name).

9 Micrologger Setup

The microloggers used by the WES CCD team have different setups depending upon the type of data to be collected. There are four different types of data collected by the microloggers: (a) Weather Station (Meteorological) Data; (b) Calibration Panel Data; (c) Radiometer Data; and (d) Thermistor Data. Appendix B describes all the components of the data collection package by manufacturer. Following are wiring diagrams for setting up the microloggers based upon the type of data to be collected.

Micrologger Setup for Weather Station Data

Air Temperature and RH Probe Wiring Diagrams (Model 207) --

Micrologger to Plug		
Micrologger Connection	**5-Pin Plug Location**	**Wire Color**
2 Low	A	Red
Excitation 2 (lower)	B	Black
2 Ground	C	Orange
2 Hi	D	White
Excitation 2 Ground	E	Blue

Air Temperature and RH Probe		
Air Temp. and RH Probe Connection	**5-Pin Plug Location**	**Wire Color**
Temp	A	Red
Excitation	B	Black
Analog Ground	C	Purple
RH	D	White
Ground	E	Clear

Rain Bucket Wiring Diagrams --

Micrologger to Plug		
Micrologger Connection	**2-Pin Plug Location**	**Wire Color**
Pulse 2 Ground	A	Red
Pulse 2 Input	B	Black

Rain Bucket to Plug		
Rain Bucket Connection	**2-Pin Plug Location**	**Wire Color**
Ground	A	White
Pulse Input	B	Black

Solar Pyranometer Wiring Diagrams --

Micrologger to Plug		
Micrologger Connection	**3-Pin Plug Location**	**Wire Color**
1 Hi	A	Red
1 Ground	B	Black
1 Ground	C	White

Solar Pyranometer to Plug		
Solar Pyranometer Connection	**3-Pin Plug Location**	**Wire Color**
Hi	A	Red
Ground	B	Black
Ground	C	Clear

R. M. Young Wind Sentry Set Wiring Diagrams --

Micrologger to Plug (Anemometer)		
Micrologger Connection	**3-Pin Plug Location**	**Wire Color**
1 Pulse Input	A	Black
1 Pulse Ground	B	Orange
12v Ground (front panel)	C	White

Anemometer to Plug

Anemometer Connection	3-Pin Plug Location	Wire Color
Pulse	A	Black
Pulse Ground	B	Clear
Earth Ground	C	White

Micrologger to Plug (Wind Vane)

Micrologger Connection	4-Pin Plug Location	Wire Color
1 Low	A	Red
Excitation 1 (lower)	B	Black
12v Ground (lower)	C	Orange
1 Ground	D	White

Wind Vane to Plug

Wind Vane Connection	4-Pin Plug Location	Wire Color
Hi or Low	A	Red
Excitation	B	Black
Ground	C	White
Shield (Ground)	D	Clear

Micrologger Setup for Calibration Panel Data

Calibration Panel Wiring Diagram --

Micrologger to Plug (Plugs directly into cal panel)

Micrologger Connection	2-Pin Plug Location	Wire Color
Hi or Low (1-8)	Small Copper Pin	Black
Hi or Low (1-8) Ground	Large Silver Pin	Clear

48

Solar Pyranometer Wiring Diagrams –

Micrologger to Plug		
Micrologger Connection	**3-Pin Plug Location**	**Wire Color**
1 Hi	A	Red
1 Ground	B	Black
1 Ground	C	White

Solar Pyranometer to Plug		
Solar Pyranometer Connection	**3-Pin Plug Location**	**Wire Color**
Hi	A	Red
Ground	B	Black
Ground	C	Clear

Micrologger Setup for Radiometer Data

Radiometer Wiring Diagrams –

Micrologger to Plug		
Micrologger Connection	**6-Pin Plug Location**	**Wire Color**
Rel 2 No	A	Red
Hi or Low (1-8) Ground	B	Black
Hi or Low (1-8)	C	Orange
Negative Ext. Battery	D	Yellow

Radiometer to Plug		
Radiometer Connection	**6-Pin Plug Location**	**Wire Color**
Power Supply	A	Red
Digital Ground	B	Black
Analog Linearized Output	C	Brown
Analog Ground	D	White
RS-232 Input RxD	E	Blue
RS-232 Output Txd	F	Green

Micrologger Setup for Thermistor Data

Thermistor Wiring Diagrams (Model 107 Temperature Probe) --

Micrologger to Plug

Micrologger Connection	3-Pin Plug Location	Wire Color
Hi or Low (1-8)	A	Red
Negative Ext. Battery	B	Black
Hi or Low (1-8) Ground	C	Clear or White

Thermistor to Plug

Thermistor Connection	3-Pin Plug Location	Wire Color
Hi	A	Red
Excitation	B	Black
Ground	C	Clear and Purple

Solar Pyranometer Wiring Diagrams --

Micrologger to Plug

Micrologger Connection	3-Pin Plug Location	Wire Color
1 Hi	A	Red
1 Ground	B	Black
1 Ground	C	White

Solar Pyranometer to Plug

Solar Pyranometer Connection	3-Pin Plug Location	Wire Color
Hi	A	Red
Ground	B	Black
Ground	C	Clear

10 Summary

Design and development of the MSD in PC environment have been completed. The MODIFY command was not implemented due to memory constraints in the PC environment. There is a known memory error in the Victor image display library in which the operation of one of the display functions is in conflict to its stated operation. This error causes the MSD software to report a Victor library error allocating memory when attempting to display an image. This error usually occurs only after several successive executions of the image display function. An attempt to resolve this error was made by contacting Cantenary System's Customer Support, but no resolution to the problem was identified at the release of this report. This problem was resolved in the version of the MSD ported to the Silicon Graphics environment, which still under development.

The data collection effort described in this report is a compilation of field tested methodology used by the CCD Research Group over the last 10 years. Some of the equipment described are highly customized versions of commercially available hardware. Data from different sources may require reformating prior to input into the MSD.

11 References

Campbell Scientific Inc. (1990). *21XL operator manual.* Logan, UT.

Catenary Systems. (1992). *Victor Library reference manual.* St. Louis, MO.

Everest Interscience Inc. (1990). *Model 4000A infrared temperature transducer manual.* Fullerton, CA.

Labsphere Inc. (1990). *Reflectance Technologies - reflectance calibration standards.* North Sutton, NH.

LI-COR Inc. (1986). *LI-COR radiation sensors.* Lincoln, NE.

Microsoft Corporation. (1990). *Microsoft C reference manual, version 6.0.* Redmond, WA.

Minolta Corporation. (1989). *Chroma Meter incident operation manual.* Ramsey, NJ.

Raima Corporation. (1991). *DB_VISTA reference manual, version 3.2.1.* Bellevue, WA.

_____. (1991a). *DB_VISTA user's guide, version 3.2.1.* Bellevue, WA.

_____. (1991b). *DB_QUERY user's guide, version 3.2.1.* Bellevue, WA.

_____. (1991c). *DB_REVISE user's guide, version 3.2.1.* Bellevue, WA.

Tracor GIE Corporation. (1990). *Instruction Manual for RST-7601 Resolution Target.* Provo, UT.

Appendix A
MSD Data Forms

Data Collection Effort

From

To

Data Collection Effort
Data Form Description

Form Description:

Complete this form for each Data Collection Effort.

Field Descriptions:

Data Collection Effort: Denotes the name of the Data Collection Effort; for example, "21st TAACOM Conspicuity Analysis." This name should be unique for each Data Collection Effort.

From Date: Denotes the first day that data were collected for this Data Collection Effort.

To Date: Denotes the last day that data were collected for this Data Collection Effort.

AREA(S) OF INTEREST

Data Collection Effort Name : _____

~~~~~~

DCE Area #   :   _____

Site Name   :   _____

Site Location   :   _____

Area of Interest   :   _____

                                 _____

Begin Date   :   _____   **End Date :** _____

Notes   :   _____

                                 _____

~~~~~~

DCE Area #   :   _____

Site Name   :   _____

Site Location   :   _____

Area of Interest   :   _____

                                 _____

Begin Date   :   _____   **End Date :** _____

Notes   :   _____

                                 _____

~~~~~~

Area of Interest
Data Form Description

Form Description:

Complete this form for each Area of Interest within a Data Collection Effort.

Field Descriptions:

DCE Area #:   A unique number used to identify each Area of Interest. This number must be unique within a Data Collection Effort.

Site Name: Denotes the name of the Site where this Area of Interest is located; for example, "Miesau Army Depot."

Site Location: Denotes the location of the Site; for example, "Miesau, Germany."

Area of Interest: Description of the Area of Interest for a particular Data Collection Effort.

NOTE: One Site may have one or more Areas of Interest. For example, the site, "Miesau Army Depot" may have two Areas of Interest, "Pomcus buildings" and "Underground bunkers."

NOTE: The maximum length of this field is 80 characters.

Begin Date: Denotes the first day that data were collected at this Area of Interest.

End Date: Denotes the last day that data were collected at this Area of Interest. Note that the begin and end dates should be inclusive of the begin and end dates specified for the Data Collection Effort for which this Area of Interest belongs.

Notes: Any miscellaneous notes that further describe the Area of Interest.

<div align="center">

DCE Area # : _____

SCENE / IMAGES

</div>

Scene Description : _____

_____

Date Captured : _____

Season : Spring   Summer   Fall   Winter

Image Collection Platform

Latitude : _____

Longitude : _____

Altitude : _____

Boresight Azimuth : _____

Images Associated with this Scene

IMAGE SPECTRUMS	IMAGE AVAILABLE FOR THIS SCENE? (Y/N)	AVAILABLE MEDIA			RECORDING MEDIA	TIME CAPTURED	IMAGE FILENAME
		S	P	V			
VISUAL							
IR3-5							
IR8-12							
NEAR-IR							
LOW-LIGHT							

Scene / Images
Data Form Description

Form Description:

Complete this form for each Scene and its associated Images within a Data Collection Effort.

Field Descriptions:

DCE Area #: Number that was assigned to the Area of Interest (on the Area of Interest Data Form) to which the Scene is associated.

Scene Description: Description of the Scene.

Date Captured: Denotes the date that this Scene was captured.

Season: Denotes the season that this Scene was captured. Circle one.

Image Collection Platform

Latitude: Latitude of the Image Collection Platform.

Longitude: Longitude of the Image Collection Platform.

Altitude: Altitude of the Image Collection Platform.

Boresight Azimuth: Boresight Azimuth of the Image Collection Platform.

Images Associated with this Scene

**Image Available for this
Scene? (Y/N):** For each available Image spectrum, enter "Y" (Yes) if an image was captured for this Scene in the specified spectrum; enter "N" (No) otherwise.

Available Media: For each Image file associated with this Scene, check "S" if a Slide is available of this Image; check "P" if a Print is available of this Image; check "V" if Video is available containing this Image.

Recording Media: For each Image file associated with this Scene, indicate the type of recording media used to capture this Image in this spectrum; for example, "VHS video," "8mm video," "35mm print or slide," "Medium Format slide," etc.

Time Captured: Time that this Image was captured, in the form HH:MM:SS:FF, where FF denotes the frame number.

Image Filename: Full file specification of the Image file associated with this Scene in the specified spectrum. NOTE that this Image file MUST be in TIFF format.

OBJECT

Object Class   :   DCA   FFWIC   FFWOC   MSWIC   MSWOC

Object Group   :   _____

Object Name   :   _____

                          _____

Object Size   :   _____ H x _____ W x _____ L   (in Meters)

Object Latitude   :   _____

Object Longitude   :   _____

Object Altitude   :   _____

If an object has CCD applied --
CCD Type   :   _____

CCD Identifier   :   _____

Visual Properties   :   _____

                          _____

Thermal Properties   :   _____

                          _____

Radar Properties   :   _____

                          _____

Other Properties   :   _____

                          _____

Object
Data Form Description

<u>Form Description:</u>

Complete this form for each Object (target) for which associated data will be collected.

<u>Field Descriptions:</u>

DCE Area #:   Number that was assigned to the Area of Interest (on the Area of Interest Data Form) where this Object is located.

Object Class: Denotes the class in which this Object can be classified. Circle one of the available options:

        1) Data Collection Activity (DCA)
        2) Fixed Facility With Camouflage (FFWIC)
        3) Fixed Facility WithOut Camouflage (FFWOC)
        4) Mobile Systems With Camouflage (MSWIC)
        5) Mobile Systems WithOut Camouflage (MSWOC)

Object Group: Denotes the group in which this Object can be classified. Groups are user-definable; examples are "pomcus warehouse," "hemtt tanker," "apache," etc.

Object Name: Denotes the unique name/description for this Object. Note that a target with CCD has a different Object Name than that of the same target without CCD because there would be different sets of data associated with that target with and without CCD. Example Object Names are "building 1001 with net," "building 1001 without net," "apache 1 (near tree-line)," etc.

Object Size: Size of the object (height × width × length in meters); for example, "3.6h × 7.6w × 24.4d."

Object Latitude: Latitude of the approximate center of the Object.

Object Longitude: Longitude of the approximate center of the Object.

Object Altitude: Altitude of the approximate center of the Object.

SCENE / OBJECTS

Scene Description : _____

_____

~~~~~~

Object Name : _____

Slantrange : _____

Look Angle : _____

==

Object Name : _____

Slantrange : _____

Look Angle : _____

==

Object Name : _____

Slantrange : _____

Look Angle : _____

==

Object Name : _____

Slantrange : _____

Look Angle : _____

==

Scene / Objects
Data Form Description

<u>Form Description</u>:

Complete this form for Object(s) within a Scene.

<u>Field Descriptions</u>:

DCE Area #:   Number that was assigned to the Area of Interest (on the Area of Interest Data Form) to which the Scene is associated.

Scene Description: Description of the Scene (on the SCENE / IMAGES Form)

Object Name: Unique name of the Object (on the OBJECT Form) contained in this Scene.

Slantrange: Distance from the Image Collection Platform to the specified Object.

Look Angle :   Angle formed by the line from the Image Collection Platform to the specified Object and the line from the Image Collection Platform parallel to the ground.

VIDEO DATA

Date	Time		Video Tape Label #				Format (check one)	
	From	To	Visual	IR3-5	IR8-12	LowLight	8mm	VHS
3/14	1400	1600	#1	#1	#1		X	
Description: Apaches on FARP								
Description:								
Description:								
Description:								
Description:								
Description:								
Description:								
Description:								
Description:								
Description:								

A12

Video Data
Data Form Description

Form Description:

Complete this form for all Video Data collected at an Area of Interest.

Field Descriptions:

Date: Date that data were recorded on the specified video tape.

Time: Begin and End times that data were recorded on the specified video tape; for example, from 1200 to 1400.

Video Tape Label #: Number labeled on the video tape(s) in which data were recorded at the specified date and time. The label # should be denoted on this form for each spectrum of data that were collected. This label number should be the same for the same video data recorded in different spectrums (at the same date and time). For example, if the same video data were collected in the Visual and IR 8-12 spectrums, then the video tapes used to record the data must have the same label # (e.g., "VISUAL #1" and "IR8-12 #1").
If data were not captured for one of the available spectrums, then leave the box for that spectrum blank.

Format: Format of video data; check either "8mm" or "VHS."

Description: Description of video data collected at that date and time.

PRINT / SLIDE DATA

Date	Roll #	Format (check one)		# Exp	Spectrum (check one)			Media (check one)	
		35mm	Med Fmt		Visual		Near IR	Print	Slide
					B&W	Color			
3/14	1	X		24		X		X	

Description: *Apaches on FARP*

Description:

Description:

Description:

Description:

Description:

Description:

Description:

Description:

Description:

Print / Slide Data
Data Form Description

<u>Form Description</u>:

Complete this form for all Print / Slide Data collected at an Area of Interest.

NOTE: The <u>PRINT / SLIDE GPS DATA</u> form must also be completed for each exposure on each roll of film in which GPS positional information is necessary. GPS positional information is optional data that can be stored with an image in the Multispectral Signatures Database; however, GPS positional information is required for accurate image analysis.

<u>Field Descriptions</u>:

Date: Date that data were taken on the specified roll #.

Roll #:   Roll number associated with print/slide (labeled on baggie).

Format: Check appropriate format, "35mm" or "Med Fmt" (medium format).

 # Exp: Number of exposures on roll of film.

Spectrum: Check appropriate spectrum, "Visual Black and White," "Visual Color," or "Near IR."

Media: Check appropriate media, "Print" or "Slide."

Description: Description of print/slide data on that roll of film.

PRINT / SLIDE GPS DATA

DCE Area # : _____

Roll #	Exposure #	GPS Time
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Print/Slide GPS Data
Data Form Description

Form Description:

Complete this form when taking still imagery for correlation with GPS positional information. It is pertinent that this form be completed for each exposure on each roll of film in which GPS positional information is necessary. GPS coordinates information is optional data that can be stored with an image in the Multispectral Signatures Database; however, GPS positional information is REQUIRED for accurate image analysis.

Field Descriptions:

DCE Area #:   Number that was assigned to the Area of Interest (on the Data Collection Effort data form) in which these prints/slides are being taken.

Roll #:   A unique number assigned to each roll of film (on the Print / Slide data form) for the Data Collection Effort from which the roll of exposed film can be identified and referenced.

Exposure #:   Exposure number on the specified roll of film for which the GPS time will be logged.

GPS Time: GPS time at which the exposure on the specified roll of film was taken. This GPS time will act as reference to a corresponding GPS position stored on other recording media.

METEOROLOGICAL DATA

DCE Area #(s)   : _____

_____

Date   : _____

Micrologger Set # : _____

Filename   : _____

Meteorological Data
Data Form Description

Form Description:

Complete this form when setting up, moving, or downloading data from each Meteorological data Micrologger.

Field Descriptions:

DCE Area #(s):   Number(s) that were assigned to the Areas of Interest (on the Area of Interest Data Form) for which this met station data will be used.

Date: Denotes the day the micrologger was set up, moved, or data were downloaded.

Micrologger Set #:   Denotes which Meteorological micrologger this is; for example, "MET-1."

Filename: Unique filename denoting the file in which the data logged by the micrologger were downloaded.

CALIBRATION PANEL DATA

DCE Area #(s)   : _____

_____

Date   : _____

Micrologger Set #   : _____

Filename   : _____

Associated Micrologger Set #: _____
  (if applicable)

Calibration Panel Data
Data Form Description

<u>Form Description</u> :

Complete this form when setting up, moving, or downloading data from each Calibration Panel Data Micrologger.

<u>Field Descriptions</u> :

DCE Area #(s):   Number(s) that were assigned to the Areas of Interest (on the Area of Interest Data Form) for which this calibration panel data will be used.

Date: Denotes the day the micrologger was set up, moved, or data were downloaded.

Micrologger Set #:   Denotes which Calibration panel micrologger this is; for example, "CAL-1."

Filename: Unique filename denoting the file in which the data logged by the micrologger were downloaded.

If more than one Calibration Panel micrologger is being used in the same Area of Interest:

**Associated
Micrologger Set #:**   Denotes the Calibration panel micrologger which is logging data corresponding to the same Area of Interest.

RADIOMETER & THERMISTOR DATA

DCE Area # : _____

Date   : _____
Object Name   : _____
Micrologger Set # : _____
Filename   : _____

Descriptions
Radiometer Set #1 :

_____

_____

Radiometer Set #2 :

_____

_____

Radiometer Set #3 :

_____

_____

Radiometer Set #4 :

_____

_____

Thermistor #1 :

_____

_____

Thermistor #2 :

_____

_____

Thermistor #3 :

_____

_____

Thermistor #4 :

_____

_____

Radiometer & Thermistor Data
Data Form Description

Form Description:

Complete this form when setting up or moving each Radiometer and Thermistor Micrologger.

Field Descriptions:

DCE Area #: Number that was assigned to the Area of Interest (on the Area of Interest Data Form) in which these measurements are being taken.

Date: Denotes the day the micrologger was set up or moved.

Object Name: Unique name of object (on the Object Data Form) about which the radiometer/thermistor data were collected.

Micrologger Set #: Denotes which Radiometric micrologger this is; for example, "RAD-1."

Filename: Unique filename denoting the file in which the data logged by the micrologger was downloaded.

Descriptions: Description of items for which the radiometers and thermistors are collecting data; for example, "brown dirt," "short grass," "evergreens," etc.

GLOSS METER DATA

DCE Area # : _____

Date   :   _____

Object Name(s)   :   _____

_____

Description   : _____

_____

Readings   : 20°   60°

_____   _____

_____   _____

_____   _____

_____   _____

Description   : _____

_____

Readings   : 20°   60°

_____   _____

_____   _____

_____   _____

_____   _____

Description   : _____

_____

Readings   : 20°   60°

_____   _____

_____   _____

_____   _____

_____   _____

Gloss Meter Data
Data Form Description

Form Description:

Complete this form when taking gloss meter measurements.

Field Descriptions:

DCE Area #:   Number that was assigned to the Area of Interest (on the Area of Interest Data Form) in which these measurements are being taken.

Date: Denotes the day that chromatic data were collected for this DCE Area #.

Object Name(s):   Unique name of object(s) (on Object Data Form) about which the gloss meter data were collected.

Description: Description of items from which gloss data were collected; for example, "olive green from rotor blade of Apache."

Readings --
20 Degrees: Values from four(4) separate 20-deg measurements.

60 Degrees: Values from four(4) separate 60-deg measurements.

SPECTRAL RADIOMETER DATA
Side A / Wide-Band Sensor

DCE Area # : _____

Date : _____

Object Name(s) : _____

_____

Tape # : _____

Side/Sensor : __A / WB_____

<u>Sample #</u> <u>Description</u>

__1___   __CLOSED_____

__2___   __2%_____

__3___   __50%_____

__4___   __75%_____

__5___   __99%_____

_____   _____

_____   _____

_____   _____

_____   _____

_____   _____

_____   _____

_____   _____

_____   _____

_____   _____

_____   _____

_____   _____

_____   _____

_____   _____

_____   _____

SPECTRAL RADIOMETER DATA
Side B / Ultraviolet Sensor

DCE Area # : _____

Date : _____

Object Name(s) : _____

_____

Tape # : _____

Side/Sensor : **B / UV** _____

Sample #	Description
1	CLOSED
2	2%
3	50%
4	75%
5	99%

Spectral Radiometer Data
Data Forms Description

Form Description:

Complete these forms when taking spectral radiometer measurements.

Field Descriptions:

DCE Area #:   Number that was assigned to the Area of Interest (on the Area of Interest Data Form) in which these spectral radiometer measurements are being taken.

Date: Denotes the day that spectral radiometer data were collected for this DCE Area #.

Object Name(s):   Unique Object name(s) (on Object Data Form) about which this spectral radiometer data were collected.

Tape #:   Unique tape number for this DCE.

Side/Sensor: Side of tape that measurements are currently being stored upon (i.e., "A" or "B") and which sensor head is currently attached to the spectral radiometer (i.e., "WB" for wide-band or "UV" for ultraviolet). Side "A" should always used for the "WB" sensor, and side "B" should always be used for the "UV" sensor.

     NOTE : The spectral radiometer needs to be recalibrated every time the sensor head is changed, as well as every time that it is powered on. The calibrations must be performed in the following order :
closed sensor, 2%, 50%, 75%, 99%.

Sample #:   Unique, consecutive sample number.

     NOTE : It is very important that every sample be accounted for, since this number (n) corresponds to the nth sample record on the tape.

Description: Description of items from which spectral data were collected; for example, "olive green from rotor blade of Apache."

CHROMATIC DATA

DCE Area # : _____

Date   **:** _____

Object Name(s): _____

_____

Bag Label #   **:** _____

<u>**Sample #**</u> <u>**Description**</u>

_____   _____

_____   _____

_____   _____

_____   _____

_____   _____

_____   _____

_____   _____

_____   _____

_____   _____

_____   _____

_____   _____

_____   _____

_____   _____

_____   _____

_____   _____

_____   _____

_____   _____

_____   _____

_____   _____

_____   _____

Chromatic Data
Data Form Description

Form Description:

Complete this form when taking chromatic data measurements.

Field Descriptions:

DCE Area #:   Number that was assigned to the Area of Interest (on the Area of Interest Data Form) in which these measurements are being taken.

Date: Denotes the day that chromatic data were collected for this DCE Area #.

Object Name(s):   Unique name of object(s) (on Object Data Form) about which this chromatic data were collected.

Bag Label #:   Number labeled on the bag where the chromo-meter printout will be stored.

Description: Description of items from which chromatic data were collected; for example, "olive green from rotor blade of Apache."

NOTE : Be sure that the measurement number that prints from the Minolta Chromo Meter matches the description number.

Appendix B
Data Collection Equipment Description

Weather Station Equipment

The typical weather station consists of the following instruments:

Description	Model	Manufacturer
Micrologger/Datalogger	21XL	Campbell Scientific Inc.
Storage Module	SM192/716	Campbell Scientific Inc.
Tripod	CM10/6	Campbell Scientific Inc.
Solar Panel	MSX-10	Campbell Scientific Inc.
Temperature/Relative Humidity Probe	HMP-35C	Vaisala Inc.
Tipping Bucket Rain Gage	TE525	Campbell Scientific Inc.
Solar Pyranometer Sensor	LI-200SZ	LI-COR Inc.
Wind Sentry	03001-5	R.M. Young
Temperature Probe	107	Campbell Scientific Inc.

Calibration Station Equipment

The typical calibration station consists of the following instruments:

Description	Model	Manufacturer
Micrologger/Datalogger	21XL	Campbell Scientific Inc.
Storage Module	SM192/716	Campbell Scientific Inc.
Infrared Temperature Transducer	4000A	Everest Interscience Inc.
Solar Panel	MSX-10	Campbell Scientific Inc.
Relay Driver	A21 REL	Campbell Scientific Inc.
Passive Infrared Target System: Low Emissivity Panel	PITS-L	Tracor GIE
Passive Infrared Target System: High Emissivity Panel	PITS-H	Tracor GIE
Solar Pyranometer Sensor	LI-200SZ	LI-COR Inc.
Temperature Probe	107	Campbell Scientific Inc.
Radiometric Contrast Target	RST-7691	Tracor GIE
Six Step Color Scale Target	RST-7611	Tracor GIE
Six Step Gray Scale Target	RST-7605A	Tracor GIE
Resolution Tri-Bar Target	RST-7601	Tracor GIE

Spectral Equipment

The following table describes all the instrumentation for spectral data gathering:

Description	Model	Manufacturer
Gloss Meter	Novo-Gloss	Macbeth Inc.
Chroma Meter	CR-231	Minolta Corp.
8° Hemispherical Spectral Reflectance Plate, 2%	SRT-02-050	Labsphere Inc.
8° Hemispherical Spectral Reflectance Plate, 50	SRT-50-050	Labsphere Inc.
8° Hemispherical Spectral Reflectance Plate, 75	SRT-75-050	Labsphere Inc.
8° Hemispherical Spectral Reflectance Plate, 99%	SRT-99-050	Labsphere Inc.
Spectroradiometer	CE500	Spectron Engineering
Infrared Pyranometer	OS-2103S	Omega Inc.
Temperature Probe & Sensor Kit	TK-2-1	Omega Inc.
Thermometer	HH22	Omega Inc.

Airborne Data Collection Equipment

The following table describes all the instrumentation for airborne data collection system:

Description	Model	Manufacturer
Medium Format Camera	645 Super	Mamiya Inc.
35mm Camera	T-70	Canon Inc.
Gated Intensified CCD Camera	ISG-250	Xybion Inc.
Low Light High Resolution Camera	ITC-510	Ikegami Inc.
HI-8 VCR	V80ABF	TEAC America
Airborne Video Insertion Generator	9991	ITS Inc.
SMPTE Time Code Generator	ES-488	ESE Corp.
Night Vision Lens	P2000A	EEV Inc.
Serial Control Titler	SCT-50	Horita Inc.
GPS/SMPTE Time Code Generator	GPS2	Horita Inc.
Global Positioning System	XAB9434	SSI
Vibration Stabilization Unit	EFP	Cinema Products

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE January 1997	3. REPORT TYPE AND DATES COVERED Report 2 of a series

4. TITLE AND SUBTITLE

Development of a Multispectral Signatures Database (MSD) for the Camouflage, Conceal-ment, and Deception Design and Evaluation Environment (C2D2E2); Report 2, User's Manual

5. FUNDING NUMBERS

Contract No. DACA39-91-C-0042

6. AUTHOR(S)

Gerardo I. Velázquez, Sandy D. Bratcher, Douglas P. Roussell

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

U.S. Army Engineer Waterways Experiment Station
3909 Halls Ferry Road, Vicksburg, MS 39180-6199;
Nichols Research Corporation
P.O. Box 820186, Vicksburg, MS 39182-0186

8. PERFORMING ORGANIZATION REPORT NUMBER

Technical Report SL-95-21

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

U.S. Army Corps of Engineers
Washington, DC 20314-1000

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

Available from National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161.

12a. DISTRIBUTION/AVAILABILITY STATEMENT

Approved for public release; distribution is unlimited.

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

This report summarizes the installation, data forms required, and the procedures for collecting the data required for the population of the Multispectral Signature Database (MSD) developed by the USAE Waterways Experiment Station (WES). The MSD is hosted on a 486 IBM PC and has undergone development in the ANSI C language. Raima Data Manager System III (RDM) was used as the underlying Database Management System. For image storage, a 24-bit color Tagged Image File format (TIFF) was used due to the flexibility and support for this format. A single-user menu interface is provided for the management of the database. Some of the operational requirements that were defined for this user interface include: organizing and cataloging a large number of images; associating appropriate attribute, ground truth, and physical data with each image; associating images of the same scene in different spectral bands; and the ability to retrieve/display images and their respective data.

14. SUBJECT TERMS

Camouflage materials	Database model	TIFF images
Database	Materials properties	
Database management	Multispectral data	

15. NUMBER OF PAGES

93

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT UNCLASSIFIED	18. SECURITY CLASSIFICATION OF THIS PAGE UNCLASSIFIED	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT